FOURTH ANNUAL REPORT

OF THE

STATE BOARD OF HEALTH

OF THE

STATE OF MAINE,

For the Fiscal Year Ending December 31, 1888.

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MAINE STATE BOARD OF HEALTH.

OFFICE OF THE SECRETARY,
Augusta, Maine, 1889.

To His Excellency, Edwin C. Burleigh, Governor, and the Honorable Executive Council:

GENTLEMEN:—I have the honor of submitting to you the Fourth Annual Report of the State Board of Health of Maine.

Very respectfully,

A. G. YOUNG, M. D.

Secretary.

MEMBERS OF THE BOARD.

FREDERIC H. GERRISH, M. D., *President*,	Portland.
HON. LEWIS BARKER,	Bangor.
PROF. F. C. ROBINSON,	Brunswick.
O. A. HORR, M. D.,	Lewiston.
E. C. JORDAN, C. E.,	Portland.
J. O. WEBSTER, M. D.,	Augusta.
A. G. YOUNG, M. D., *Secretary*,	Augusta.

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INTRODUCTORY.

Since the establishment of the State Board of Health another, the fourth year has passed, and in this we have the honor to present to the people of our State, the Fourth Annual Report of the State Board of Health. During the year 1888 the quiet of the commonwealth has been disturbed by no intelligence of approaching foreign pestilence, yet to a considerable extent, it is believed, intelligent and correct ideas have leavened the minds of the people in regard to the methods of preventing, and the need and practicability of preventing those indigenous maladies whose combined mortalities exceed that of the imported pestilences (small pox, cholera, yellow fever, etc.) as the darkness of the night exceeds that of the day.

One of the infections which has planted itself in the midst of most of our New England communities so that we at all times may be assured that it is not far away, is diphtheria, a disease which, in its protean forms, is truly the pestilence that walketh in darkness. Unfortunately the people in some places have been subjected to loose and false teaching, and are, therefore, resting in a state of indecision as to the contagiousness of this disease. Consequently in outbreaks of diphtheria, there is sometimes a failure to take prompt measures to check the malady. There ought to be a public demand in every town which would drive the local boards of health to do their duty in little emergencies of this kind instead of opposing and restraining them, as sometimes occurs; and, at the same time, there should be just as urgent a demand that the hardships and inconveniences of a temporary isolation, shall be mitigated as far as is compatible with the general safety. We bespeak for both the local boards of health and afflicted families a little more of active public interest, when these calamities occur. Two or three men cannot always stand up in a cold atmosphere of indifference and do that which is for the best interests of all.

As regards diphtheria, though we have much to learn about the conditions which favor or antagonize its spread, we are sure it is communicable, and like all infectious diseases may be greatly restricted by intelligent and especially by united effort. The truth of the latter assertion has been demonstrated by the State Board of Health of Michigan. We reported in the *Sanitary Inspector* that in Michigan during the year 1886, there were in those outbreaks (102) in which it is known that isolation or disinfection were neglected, an average number of 16.18 cases to each outbreak; in those outbreaks (243) in which it was not known whether isolation or disinfection were done, there was an average of 4.54 cases to each outbreak; while in those outbreaks (116) in which isolation and disinfection were known to have been carried out, the average number of cases to each outbreak was only 2.86. For 1887 the figures were as follows:

Isolation and Disinfection.	not carried out	cases,	11.87
		deaths,	.82
	doubtful	cases,	6.32
		deaths,	.49
	carried out	cases,	2.31
		deaths,	.17

In our own State as nearly as we can judge with our limited statistical resources, there was no unusual prevalence of diphtheria during the year, and nevertheless cases were reported from 126 of the 430 towns. In some of the towns its prolonged prevalence was undoubtedly due to the want of that public interest which we have deplored.

The history of diphtheria at the Insane Hospital shows that it was started by one of those accidental introductions of infection which are sometimes unavoidable. Unfortunately, I think the sequence of events may justify us in saying, the early cases which resulted were of so mild and questionable a character that the institution was infected before the true nature of the disease was recognized.

Another of our native diseases which tends to swell our death rates is typhoid fever, and the greater is the pity, and we might say our shame, since the conditions under which the infection is transmitted are so well known and so preventable, and its origin is so ignoble. We have read with feelings of pity for their ignorance and disgust at their nastiness, Koch's description of the habits of

the inhabitants of India, and of the filthy condition of their water tanks in which he found the cholera bacillus.

And yet typhoid fever is a disease which has considerable etiological relationship with cholera. It, like cholera, is dependent upon a germ, the derivation of which is from the intestinal contents; and, as in cholera, the most frequent way of becoming infected with typhoid fever is to drink the excretions of typhoid fever patients, or the bacilli which are derived from their excreta. If we do not, as the natives of India do, wash our dirty and infected clothes directly in our water supplies, we do, some of us, pour our slops and excretions where they may run or soak into wells or springs used as sources of drinking-water or empty our sewage into public water supplies.

The prevalence of typhoid fever varies very much in different countries and different towns in accordance with the chances for polluting their water supplies. We would refer our readers in this connection to pages 172 and 275 of this report. In France the annual loss of the country from typhoid fever is enormous, especially in the army, and the leading sanitarians are calling upon the government to put a stop to so disastrous and useless a tax.

In our state with its super-abundance of water supplies of good quality, the mortality from typhoid fever should be smaller than in many of the other states, and it probably is so, though until we have an accurate system of vital statistics we can deal only with probabilities. During the year typhoid fever was reported from 181 towns. No large outbreaks occurred. It will be noticed that the conditions for soakage into the shallow wells,—gravelly soil and underlying stratum of clay,—were much alike in connection with the Washburn outbreak (page 17) and that at Pierrefonds, France (page 278).

During the year there was a greater prevalence of scarlet fever than in 1887, mostly in a mild form, and on account of this mildness, restrictive measures were not taken as otherwise they might have been. Scarlet fever was reported in 92 towns.

The most encouraging result of modern sanitary investigations is the demonstration that consumption is an infectious disease. We say encouraging because infectious diseases are invariably preventable, in a degree depending upon the characteristics of their contagia, the amount of knowledge which we have of these character-

istics, and the extent to which we can lead the people, to be careful not to multiply the chances of infection or to expose themselves to them.

As regards consumption, or tuberculosis of the lungs, most of the qualities of the infection favor escape from it: it is not capable of multiplication outside of the animal body, though it may preserve its vitality for some time; its contagiousness is of feeble intensity, that is, it is a micro-organism of slow growth and needing personal predisposition, a preceding or intercurrent affection of the respiratory organs, or prolonged exposure in infected areas to enable it to "take;" it is not given off by the breath of the patient; practically the only source of danger is in the expectoration of the consumptive patient and this is harmless until it is dried, pulverized and diffused in the atmosphere. The most hopeful measure of prevention, therefore, appears to be to diffuse generally a knowledge of the importance of properly disposing of the sputum. In this connection we would refer our readers to the paper on page 192 and what follows, especially to the valuable papers of Dr. Cornet, of which translations in abstract are given.

Water Analysis.—The results of the chemical analysis of the public and private water supplies made during the year, we choose to consider as only preliminary to a fuller study of our potable waters, to be made in the future. Analyses were made during the year of all the public water supplies in the State as far as they were known, including the water supplied by twently-four water companies, with a service extending to twenty-seven different cities and villages. Under the heading "Miscellaneous Analyses" are tabulated the results of the analyses of 116 samples of water mostly derived from private sources. It has been the aim of the Board to make the Laboratory helpful to the private citizens of the State as far as possible, and with that view the Secretary has tried to interpret the results in as plain a form as possible, writing sometimes at considerable length and often advising as to practicable measures of relief from existing conditions or from future danger. It will be seen that applications for analyses have come from all quarters of the State. In a few instances, the examination of samples of water from proposed public supplies has conclusively shown that they were wholly unfit for that purpose, and the idea of using them was consequently abandoned. In connection with the samples from

private sources it should be borne in mind that in most cases, they were from wells, springs, etc., that were already suspected, or thought to be polluted. The histories of some of the samples, as given in the "Notes" on page 62, are very instructive, especially when read with the results of the analysis.

Local Boards of Health. — The prompt removal from our towns and villages of the waste products of our social and domestic life, thereby presenting the aspect of thrift, and the removal of those conditions and causes which are productive of unavoidable disease and death, are important items in municipal, state and national prosperity. Untidy and malodorous streets and premises are far from being inviting, and towns often ravaged by infectious diseases or notable for the excessive prevalence of sickness, are repellent not only of people but of capital. As the public guardians of the rights and interests of the public in these directions may be regarded the local boards of health. How they have done this work the extracts from their annual reports will tell in part. There are differences, of course, in the conditions and requirements of towns; there are as great differences in boards of health as to their interest in the public welfare; there are also great differences in the mental and moral make-up of communities, as to the sense of personal and moral responsibility for what ought to be, or ought not to be. Upon the whole the local reports show that much good work has been done in the State. One important part of local public health work is the diffusion of useful sanitary information. To aid the local boards in this work circulars have been issued on various subjects by the State Board for distribution by the local boards or for the use of individuals when applying for them, and others are soon to follow. Among the circulars which are kept constantly in print by the board are the following, many of which have had a wide circulation in the state:

Form 21 Practical Facts about Cholera.
" 23 Earth Closets.
" 26 Small-pox.
" 27 Does Vaccination Protect?
" 29 Treatment of the Drowned.
" 30 Contagious and Parasitic Diseases of Animals.
" 38 Disinfectants and Their Uses.
" 40 Rules for House Drainage.

Form 44 Diphtheria, Its Prevention and Restriction.
" 45 Scarlet Fever, Its Prevention and Restriction.
" 46 Typhoid Fever, Its Prevention and Restriction.
" 47 Is Diphtheria Contagious?
" 48 Isolation of the Infectious Sick.
" 50 Contagious Diseases and Contagion.

The special paper on "Sanitary Methods in Portland," by Mr. Burgess, the Secretary of the Local Board of Health of that city, is brief but very valuable, and is worthy of a careful reading by the members of other local boards of health. Seven years ago just after the organization of the Provincial Board of Health of Ontario, a committee of that board visited the offices of several of the state boards of health and some of the cities on this side of the line for the purpose of examining their methods of conducting their sanitary work. On their way home they called at Portland and dismissed the principal city of Maine with these few not very complimentary words: "The organization there is very poor and defective, and there was little information to be obtained." Since then a very great change has taken place and committees from the municipal boards of health of other states find it worth their while to visit Portland for the purpose of inspecting the sanitary methods which are there in operation.

At the Milwaukee meeting of the American Public Health Association last fall, when the "Report on the Pollution of Water Supplies" was read, it was the unanimous opinion of the members present that the paper contained so much of practical value that it should be printed in pamphlet form immediately, that it might be available to the public without awaiting its publication in due order in the Transactions of the Association, and a vote was taken to that effect.

The paper by Dr. Whittier on "Light Gymnastics for Schools" we believe to be of more than usual worth as compared with most other papers on the same subject. The movements are entitled to the claim of much originality, and a high recommendation of the paper is the fact that it is prepared by one who is thoroughly acquainted practically and theoretically with his subject, and we feel sure that progressive teachers and school officers will receive this contribution to so important a subject with much pleasure.

SECRETARY'S REPORT.

The following is a report of the work of the State Board of Health for the year 1888, excluding mostly that important part, viz.: the routine office work. The latter in co-operation with the work of the local boards of health in restricting the more common infectious diseases, and in bringing about those changes which tend to increase local and general salubrity, is of the greatest worth locally and to the State at large; but the individual acts in the ordinary daily work are of only local and temporary interest, and, therefore, should have but little space in a report designed for general interest and for general usefulness.

The membership of the Board remains the same as when the last report was made. At the annual meeting held in March, Dr. Frederick H. Gerrish, was unanimously re-elected President. The vacancy which was occasioned by the expiration of the term of office of a member was filled by the re-appointment of Dr. Horr by the Governor.

The names and addresses of the members of the Board, with the dates at which their terms of office expire, are as follows:

HON. STEPHEN J. YOUNG, Brunswick, term expires January 31, 1889.

HON. LEWIS BARKER, Bangor, term expires January 31, 1890.

FREDERICK H. GERRISH, M. D., Portland, term expires January 31, 1891.

J. O. WEBSTER, M. D., Augusta, term expires January 31, 1892.

E. C. JORDAN, C. E., Portland, term expires January 31, 1893.

O. A. HORR, M. D., Lewiston, term expires January 31, 1894.

At the annual meeting in March, the following committees were appointed for the ensuing year:

On Finance—the Hon. Lewis Barker, J. O. Webster, M. D., and the Secretary.

On Disposal of Excreta—F. H. Gerrish, M. D.

On Ventilation—O. A. Horr, M. D.

On Sewerage and Drainage—E. C. Jordan, C. E.

On Water and Water Pollution—J. O. Webster, M. D.

On School-Houses and School Hygiene—A. G. Young, M. D.

On Publications—Frederick H. Gerrish, M. D., J. O. Webster, M. D., and A. G. Young, M. D.

SMALL-POX AT CUMBERLAND MILLS.

The State Board of Health was notified of the existence of small-pox at Cumberland Mills, March 15, and subsequent investigations developed the fact that this disease in an unrecognized form had been present in that village for a period of nearly two months.

The first cases occurred in a house owned by a Mr. Washburn. Sometime in December, 1887, Mr. and Mrs. Washburn, with their only child, a daughter of ten years, went to another town on a visit. They left in charge of their house, and residing in it, a young man by the name of Harriman, with his wife and their child two or three years old. The Washburns returned to their home January 24th, and found Mrs. Harriman ill with what the attending physician called chicken pox. Mrs. Harriman worked in the rag room of the Cumberland paper mills, and had become sick and left the mill January 21. The northern half of the room where she worked is occupied by tables, upon which, from January 2nd to February 2nd rags only of the kind known as "English Whites," or "English Outshots," were worked; and the southern part of the room is filled with tables upon which only Japanese rags had been handled.

Seventeen days after Mrs. Harriman became sick (February 7th), Mr. Harriman was attacked, two weeks later (February 21st), their child sickened; and still fifteen days later (March 7th), the Washburn girl fell ill.

The cases so far, all in the same house, had been mild, and all went by the name of chicken-pox. Mr. and Mrs. Harriman had both been vaccinated, but not recently. The children had never been vaccinated, but the disease was nevertheless mild, especially

in the case of the Harriman child. Mr. and Mrs. Washburn bear the marks of successful vaccinations made two years ago, and both escaped without contracting the disease.

March 12th, a woman became sick who lived near the Washburn house, and who was in and out freely during the sickness of the inmates. She had confluent small-pox. Of the cases so far mentioned, only the initial case can be supposed to have been contracted from the rags, as none of the patients had been employed in the mill except Mrs. Harriman. In regard to the two cases next to be mentioned, there is some doubt as to whether the infection was derived directly from the rags or not.

Millie Ricker, who worked in the rag-room, was attacked March 6th, and died on the 10th. The diagnosis in her case was malignant scarlet fever; and the opinion of the attending physician was confirmed, the evening before her death, by three consulting physicians. It was said that all the usual characteristic features of the small-pox eruption were absent, and that there was present only a scarlatiniform eruption with some purpuric spots.

Miss Varney, who worked in the rag-room, was attacked with small-pox March 12th. She had the disease in a moderately severe form.

The following facts are interesting as bearing upon the question of whether more than the primary case had its origin directly from the rags:

After Mrs. Harriman's slight illness, she returned to the mill, and worked from February 6th, until tho 10th, of the same month. She then left to take care of her husband, and remained out until the 23rd, of February, when she again came in, and worked until the 25th. When she returned on the 23rd, she was transferred, for that day only, to a table in the south half of the rag-room, where Miss Ricker and Miss Varney worked.

When the State Board of Health was notified of the existence of small-pox at Cumberland Mills, the first three cases had recovered, three cases had just been quarantined by the local board of health of Westbrook, and the remains of the so-called scarlet-fever patient had been transported forty miles to Brownfield and interred, and had been accompanied by the sister of the deceased, Carrie Ricker, who had worked with her in the mill and had roomed with her.

Ten days after the death of Millie Ricker, Carrie became sick and died, as her sister had, after only four days of sickness, and of

what her attending physician also called malignant scarlet fever. In this case there were no purpuric spots, and, according to the description which was given by the attending physician, the rash was very much like that which characterizes scarlet fever, and lacked all the distinctive appearances of the ordinary small-pox eruption.

These girls had neither had scarlet fever nor been vaccinated.

In spite of the unanimity of the medical attendants in regard to these two cases, there were certain features which raised a doubt of the correctness of the diagnosis and called for a strong precautionary warning to the local boards of health immediately concerned. In addition to the fact that the first of the two so-called scarlet fever cases had worked in the mill, the period of invasion was longer than is characteristic of scarlet fever, especially of the malignant forms of the disease; and in the second case, both the period of incubation and that of invasion corresponded more nearly to those of small-pox. Therefore, when the Secretary of the State Board received a telegraphic message announcing the death of Carrie Ricker and saying that she died of malignant scarlet fever he nevertheless telegraphed to the Secretary of the local board of health to continue to disinfect and vaccinate.

Ten days after the consultation on the first of these two cases, and exactly on the same day when the second of the sisters was attacked, one of the consulting physicians came down with varioloid. Later, the man who kept the boarding-house where these girls roomed had varioloid, contracted presumably from the bedding which he took care of after the fatal termination of the first case.

But another case in Brownfield settled beyond cavil the question of the nature of these doubtful cases. A brother of the Ricker girls, a boy of fourteen or fifteen years of age was taken April 4th, twelve days after the death of the second sister, with small-pox in an unmistakable form. This boy had been vaccinated, but unsuccessfully, several times immediately after the death of the sister who died at Cumberland Mills.

Two cases occurred in Deering, among relatives of the Harriman's, who visited them before the nature of their malady was known.

One other case, presumably varioloid, but of somewhat questionable character, on account of the rather late stage at which it was first seen by a physician, occurred at the village of Saccarappa. This patient had not been exposed to the small-pox infection, excepting through the possibility of its conveyance in the clothing of some of her associates.

In this connection, it is a pleasure to bear testimony to the efficient and faithful work which was done by the several local boards of health of those towns which were threatened with danger from the small-pox infection, and on account of the large amount of executive work which was done faithfully and promptly, the secretary of the local board of health of Westbrook, Mr. H. K. Griggs, is deserving of especial mention. Apparently everything was ready for a wide spread epidemic of small-pox, but by the prompt isolation of the sick and those who had been exposed, free vaccination and disinfection, the outbreak was restricted to remarkably narrow limits.

In conclusion we may refer to several important facts which this outbreak helped to illustrate in some degree:

1st. That though a very slight exposure to the infection of small-pox is often sufficient to reproduce the disease in another person, oftentimes, on the contrary, extensive comingling of infectious persons with others fails to infect, or at most gives rise to a number of cases not at all commensurate with the apparent amount of exposure. For more than seven weeks the disease passed for chicken-pox and no precautions whatever were instituted all this time against the spread of the infection. After Mrs. Harriman's illness she returned to the mill Feb. 6th, and worked four days; then on account of the sickness of her husband she was out until the 23rd, and upon her return to the mill she worked three days more and then left on account of the sickness of her child. In the rag-room there were at this time over one hundred persons at work.

2nd. That the first cases in the outbreak of small-pox particularly when they are modified by previous vaccination (varioloid) are very often mistaken for chicken-pox.

3rd. That in certain cases of small-pox, particularly in some of the malignant forms, a correct diagnosis is not always easily made. In some of these cases, and this appears to have been true in regard to the Ricker girls, the rash lacked all the usual characteristics of the small-pox eruption, and in place of it, there was substituted a scarlatinaform eruption which bore a striking resemblance to the rash of scarlet fever. Indeed it is acknowledged that in some exceptionable cases, from the eruption alone, it is impossible to surely discriminate between small-pox and scarlet fever. In the consultation over one of the cases which was called scarlet fever, all of the four physicians in attendance had had some previous ex-

perience with small-pox, and one of them, at least, much. We are bound to admit, therefore, that whether or not the etiological causes of the infectious diseases are characterized by immutable specific features their symptomatology is not.

4th. The value of vaccination was strikingly shown in some instances. A young woman, a room-mate of the Misses Ricker refused to leave Millie during her sickness but stayed with her until her death, acting as her nurse and was clapsed about the neck by the arms of the expiring girl at the moment of her death. She escaped unharmed. She had been vaccinated successfully two years previously. Mr. and Mrs. Washburn, successfully vaccinated two years previously, escaped the disease. At the time when Mrs. Harriman twice returned to the mill, presumably bearing infection, there were 106 persons at work in the rag-room. Of these 56 had been vaccinated three years previously, and two others within the year. Of the 48 remaining persons one had been vaccinated within four years; 4 within eight years; 13, ten years ago or more; 8, fifteen years ago or more; 10, twenty years ago or more; 5 had never been vaccinated; 5 had previously had small-pox; and regarding 2 the history of the vaccination was uncertain. Without any statement with regard to the proportion of successes of vaccinations, it is apparent that a large majority of the workers in the rag-room were protected by previous vaccination, and it was unquestionably due to this protection that the number who contracted the disease in this room was so small. Of the five who were wholly unprotected by vaccination, three took the disease in a severe form, and in two of these three cases, the disease assumed a malignant and rapidly fatal form.

5th. That there is considerable danger of outbreaks of small-pox originating from infected rags in paper-mills, and that outbreaks thus originating not only result in loss of life but are the cause of much annoyance, suffering, and expense, to corporations, individuals, and towns. This Cumberland Mills outbreak originated unquestionably from infected rags in the rag-room; the last small-pox outbreak before this, the one in Gardiner in 1887, originated similarly in an operative in the rag-room, in one of the paper mills, in that town. In the first annual report of the local board of health of Poland the secretary states that: "The most important thing in this village from a sanitary point of view is the danger of small-pox from rags brought here from American cities. There have

been no less than four such outbreaks during my nineteen years of residence here. Six or eight persons, I think, have died from this cause."

In fact wherever paper mills using rags are located, almost without exception, outbreaks of small-pox have more or less frequently arisen, due apparently to the infectious qualities of the rags, and this has so generally been the experience with industries of this kind that the subject has received much attention at the hands of health authorities in this country and abroad. Without going any further into the discussion of what has been done and said in relation to dangers of this kind and the means of obviating them we will say that so far as small-pox is concerned a remedy reasonably sure exists in vaccination. At an adjourned meeting of the State Board held in July the danger from infected rags in the paper mills was fully discussed and in view of this risk it was the opinion of the board that it is desirable that every person that is employed in these mills where rags are used in the manufacturing of paper should be vaccinated, and in accordance with the vote to that effect, Drs. Horr and Young were appointed a committee to take action in this matter.

At the next meeting this committee reported the draft of a model by-law for use in those towns where paper mills using rags are located and the by-law as presented by the committee was approved by the Board.

A copy of this by-law was sent to the local board of health of those towns which contain paper mills with the advice that it should be adopted by the local boards of health. The local board of health in two of these towns immediately adopted the suggestion of the State Board and presented the by-law to one of the Justices of the Supreme Judicial Court for approval. The Judge suggested that the proposed by-law was so eminently wise and proper in its form and purposes that it ought to be made a state law instead of merely a local by-law. The by-law, therefore, which consisted of the first four sections of the following act was drawn up in the form of a bill and presented to the Legislature and before going to press we are enabled to include the approved act in this report.

An Act to provide against the danger of the spread of Small-Pox from Paper Mills.

Be it enacted by the Senate and the House of Representatives in Legislature assembled, as follows:

SECT. 1. No owner, agent, or superintendent of any paper mill where domestic or foreign rags are used in the manufacture of paper shall hire or admit any person to work in or about said mill who has not been successfully vaccinated or revaccinated within two years, or to the satisfaction of the local board of health.

SECT. 2. No person shall work in or about any paper mill where rags are used, who has not been successfully vaccinated or revaccinated within two years, or to the satisfaction of the local board of health.

SECT. 3. The owner, agent, or superintendent in every paper mill where rags are used shall every year in the months of February and September, make out and deliver to the local board of health, a list containing the names, ages, kind of work, and places of residence of all persons employed in or about said mill.

SECT. 4. In the months of March and October, annually, each and every person who is employed in a paper mill, shall be examined by the local board of health as to whether he or she is successfully and sufficiently protected by vaccination and the local board of health shall in all cases be the judges of the sufficiency of the protection by vaccination.

SECT. 5. Any person who shall violate any of the provisions of this act shall be guilty of a misdemeanor, and upon conviction thereof shall be subject to a fine of not more than fifty dollars.

SECT. 6. It shall be the duty of the local boards of health within their respective jurisdictions and of the State board of health, to enforce this act as far as comes within their power, and when said State board of health knows or has reason to believe that any penalty or forfeiture has been incurred by reason of neglect to comply with said act, it shall, at its discretion, give notice thereof, in writing, to the county attorney of the county in which said penalty or forfeiture has occurred, and upon receipt of such notice the county attorney shall prosecute the defaulting person or persons.

[Approved Feb. 23, 1889.]

DIPHTHERIA AT THE INSANE HOSPITAL.

In the early part of July 1888, diphtheria broke out in the State Insane Hospital and the history of the tenacity with which it has held that institution is illustrative of the difficulty which is sometimes met in expelling this disease from localities in which it has entrenched itself. Repeated examinations by the Secretary, sometimes with other members of the State Board of Health, have been convincing that nothing as regards the sanitary conditions or arrangements had anything to do with the beginning of the outbreak, whatever may be thought of some unfavorable circumstances which may have contributed to its continuance. The most reasonable explanation of the origin of the epidemic may be found in the following facts:

A young man, Mr. J., returned from New York to his home in Vassalboro, June 15th. Two days later he was attacked with a rather severe throat disease with which he suffered four days, June 17th to the 20th. He had no medical attendance, and had no suspicion that his throat trouble was diphtheretic, but was ill enough to keep his bed two of the days. On the 23rd of June he went to the Hospital as an attendant in the wards. On the 24th or 25th his brother who had been with him at home, came down with diphtheria, and a physician being called, his case was recognized as one of diphtheria, and as such was reported to the local board of Vassalboro and to the State board.

Diphtheria in a well marked form and to be recognized as such did not occur in the hospital until about the middle of July, but in the interim, there were various cases of sore throat among the patients, attendants and clerks, which it seems reasonable now, to refer to the list of cases of mild diphtheria.

Among these mild early cases, Mr. C., clerk in the treasurer's office was one of the first. He had marked throat symptoms as early as July 4th. After a few days there was an improvement, and then a relapse, so that the inflammation of the throat lasted altogether until about the 11th of July. Upon the day of Mr. J.'s arrival he and Mr. C. stood close together some time in the treasurer's office talking, each resting an elbow on a high desk. To this incident Mr. C. is now inclined to refer the origin of his sore throat.

Other cases of sore throat appeared in the wards, in the persons of patients who had come in contact with, or in proximity to the attendant J. Mr. J. was at first set to work as an attendant in the lower ward in the second wing on the male side, and while acting as attendant in his own ward, he relieved the attendant occasionally in the lower ward of the third wing. All the early cases occurred in these two wards in which J. acted as attendant.

Representing J.'s ward as ward A, and the one in which he relieved as ward B, we would state that the rooms in which the earlier cases appeared were as follows: Patient, (doubtful case) in ward A; patient, (doubtful case), ward B; July 12th, patient, ward A; July 13, patient, ward B; July 17th, patient, ward B; July 17th, patient, ward A. About July 11th, Mr. J. was put in charge of the middle transverse ward in which maniacal patients are confined. One of these violent patients which he had charge of July 11th, became the next on the list. Mr. J. found it necessary to put his arm sometimes about this patient's neck to control him, a position favorable to taking the breath of the attendant. This patient took the disease on the 18th, and died after only two days illness of a most malignant form of diphtheria.

On the 16th, of July it being very evident that diphtheria was present in the hospital, the old private wards at the west end of the male second wing were opened as rooms for the isolation of the diphtheria patients. The single door on each floor between these wards and the other parts of this wing was sealed up, leaving the entrance to these isolation wards only from the open air.

These isolation rooms were supplied with special nurses who were not permitted to enter the other portions of the hospital. All the patients in the hospital were closely watched and examined daily for the purpose of detecting the first symptoms of new cases. Patients who were suspected of having incipient diphtheria were isolated outside the infected ward, and kept under observation until it could be determined whether they had diphtheria or not.

At first, with the too small number of medical attendants in the institution, the Superintendant and his assistants were compelled to attend the diphtheria patients, and at the same time take such precautions as they could to avoid spreading the disease.

At the September meeting of the State Board of Health, a resolution was passed expressing the desire of the Board to make itself useful to the Trustees of the hospital in every way possible and at

the same time earnestly urging that a special medical attendant be employed to attend the diphtheria cases. Some difficulty being found in making any other arrangements, the Drs. Martin of this city finally took charge of the diphtheria patients.

Another suggestion was put into practice very promptly by the Superintendent and Trustees, that relating to the fitting up of a steam disinfector. An extemporized disinfector was made by building against the outside of the laundry a matched pine plank box, seven feet and eigh inches high, four feet wide and three feet deep. Its door in front was hung with three heavy iron hinges, and was closed against stripes of listing by means of straps of iron shutting over bolts on which heavy thumb screws worked. In the top, slats were supplied with an abundance of hooks on which to suspend clothing. The size of the disinfector permitted the disinfection of a lounge or of several bed mattresses at the same time. The steam pipe entered the bottom of the chamber. I have twice personally tested this apparatus when steam at from thirty-five to forty pounds was turned on. A narrow perpendicular glass window gives a view of the thermometer which hangs against it on the inside. Each time the temperature reached 215° or 216° F. within three minutes, a degree of moist heat sufficing for the sure destruction of infection. The leakage of the chamber converts it practically into an apparatus for the use of steam flowing in a free current, and under but slight pressure.

The general work of disinfection has been carried out as follows: All clothing which has been in use by the patients is immersed in a 1 to 1000 solution of corrosive sublimate, in which it soaks several hours or over night; it is then carried to the steam disinfector and subjected for at least an hour to the action of the steam at a few degrees above the boiling point; from the disinfector it goes into a special stationary tub in the adjoining laundry where it is boiled. Thus it goes through three processes any one of which is undoubtedly sufficient to render it entirely harmless. All mattresses, lounges, easy chairs and other articles which have become infected in the isolation rooms, or have incurred the suspicion of infection in the wards are steamed in the disinfector, though this treatment is quite trying to the joints of the furniture. The woodwork, floors, walls and furniture are washed down with the 1 to 1000 solution of corrosive sublimate.

Several times it was hoped that the prevalence of the disease had finally and permanently ceased. During the periods from October

17th, to November 17th, January 7th to 22nd, and March 19th to April 12th no new cases occurred, and during each interim most thorough and continued work was done by the attendants in the infected wards, in disinfecting and cleansing, but each time the subsequent appearance of new cases has been a bitter disappointment, and has necessitated the re-occupation of the isolation rooms.

From the beginning of the outbreak to May 1st, 1889, there have been sixty-four cases of diphtheria in all, distributed by months as follows: July, 8; August, 14; September, 9; October, 5; December, 14; January, 4; February, 3; March, 1; April, 1.

Among these sixty-four cases, eleven deaths have occurred.

Eight of these deaths occurred among the first thirty-two cases, and three among the last thirty-two cases.

Of the sixty-four cases, thirty-nine were among the patients, and twenty-two among the attendants. Two cases occurred in the persons of workmen who boarded at home but who were quarantined in the isolation wards when they took the diseased, and one case occurred in a workman who roomed at the hospital.

Of the eleven deaths which have occurred, nine of them were among the thirty-nine patients who had the disease, and two were among the twenty-two attendants; thus giving a percentage of fatal cases among the patients of 23, and among the attendants of only 9.

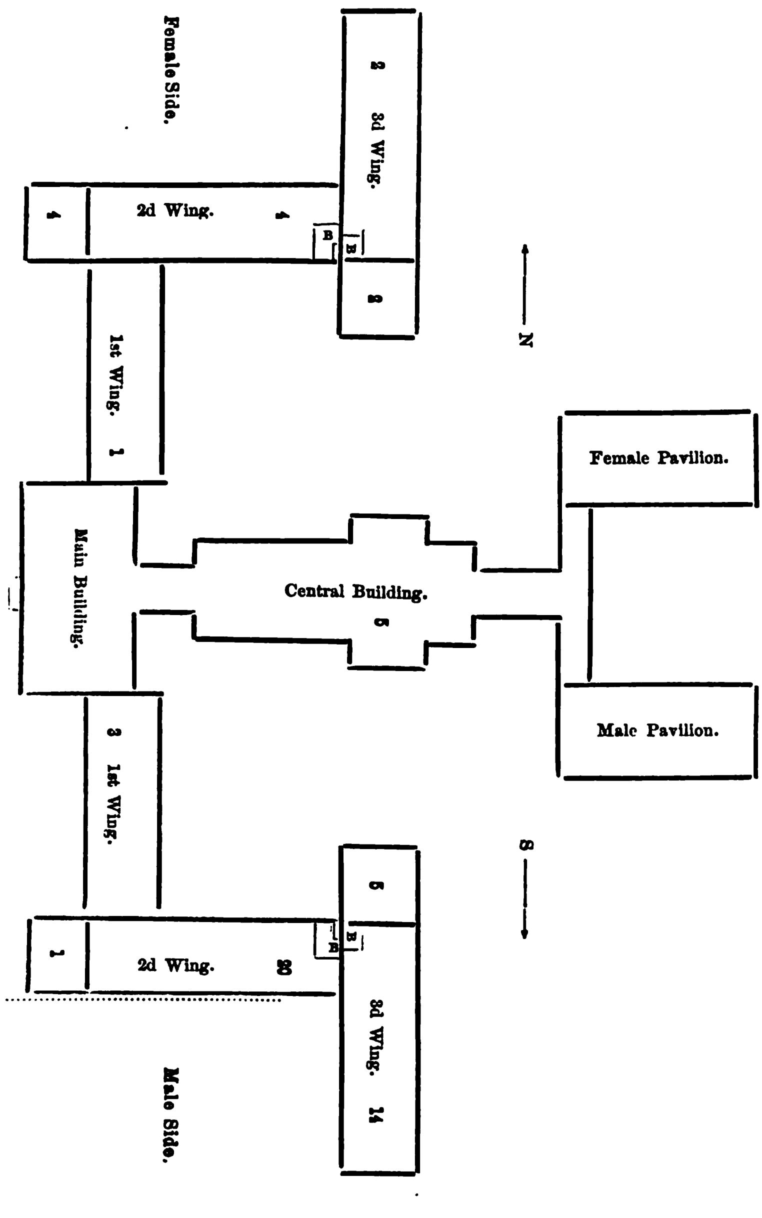
Distributed as to locality, there have been the following number of cases in each building, wing or pavilion:

Male Side.		Female Side.	
1st wing	3	1st wing	1
2nd wing	20	2nd wing	4
3d wing	14	3d wing	2
Transverse	5	Transverse	2
Pavilion	0	Pavilion	0
Isolation wards	1	Old private wards	4

Front centre building	0
Rear centre building	5
Old chapel wards	1
Laundry and engine house	0
In persons boarding at home	2

NOTES.—The transverse wards are where the maniacal patients are confined. The one case credited to the isolation wards occurred in one of the nurses. The "old private wards" on the female side are occupied by the attendants only. The five persons in the rear centre building, who had diphtheria, only roomed there.

The twenty-two cases among the attendants were distributed as to the location where they worked or roomed, as follows:


Female Side.
3d Wing.
2d Wing.
1st Wing.
Main Building.
Central Building.
Female Pavilion.
Male Pavilion.
1st Wing.
2d Wing.
3d Wing.
Male Side.
N
S

Male Side.		Female Side.	
1st wing—		1st wing—	
Lower ward	1	Lower ward	1
2d wing—		2d wing—	
Lower ward	5	Lower ward	1
Upper ward	1		
3d wing—			
Lower ward	1		
Transverse—		Old private wards	4
Middle ward	2		
Upper ward	1		
Isolation wards	1		
Rear centre building	4		

Thus it is seen that the disease has continued in spite of the large amount of hard and careful work which has been done, and as the results of our personal observations during several consultations with the Superintendent and Trustees, and many visits from July 16th to the present time, we are led to the following conclusions as to the conditions and circumstances which have contributed to prolong the outbreak.

In the first place, the institution is badly overcrowded. The average number of 580 patients has filled all the rooms at their disposal, and left about 125 patients to be disposed of at night by camping them down on cot-beds, lounges, etc., in the corridors. One night I counted 23 patients thus huddled down in a single ward. In the morning this bedding has to be packed away, and if, later in the day, one of these "camped down," roomless patients is found to have diphtheria, his bedding has necessarily been stowed away, and, whether it can be recognized or not, it has had the possibility of infecting the other bedding.

Though disinfection of rooms and wards has been done as well as possible where cases have occurred, the overcrowded condition has made it impracticable to vacate a whole ward and give it a complete disinfection.

In the second place, though a careful watch has been kept by the ward attendants and by the physicians for the first symptoms of new cases, that condition of mental clouding which has befallen many of the insane inmates, renders it very difficult to detect every case early, and possibly some mild cases which were wanting in symptoms which would attract attention, have escaped detection altogether.

Again, the isolation wards are on the west side, or end, of the series of wings which constitute the male part of the institution,

and, consequently, the prevailing winds can be conceived as showering infection upon these two wings (the second and third) in which the disease has been by far the most prevalent.

Another condition may be enumerated as a possible cause. The sewer which takes the sewage from the six bath-rooms and closets of the second and third wings on the male side, is of brick, runs west parallel with the second wing and is only six or seven feet outside the foundation walls. The position of this sewer is shown by the dotted line.

In accordance with the views of Dr. Sternberg and some other authorities, the germ of diphtheria, when once introduced into moist and filthy places may continue to live and thrive independently of the human organism. Admitting, in the light of many epidemiological observations, the probable truth of this view, we may conceive that the brick-work of the sewer to which I refer, and possibly the earth which backs it, may be in a permanently infectious condition.

With the view of possibly throwing light on this question, Dr. Sanborn, the Superintendent of the Hospital, and the writer tested this south sewer and the drain pipes and fixtures connected with it, by sending a man to pour a large quantity of oil of peppermint down the soil pipe from the roof, previously sealing up the fresh-air inlet, and all the windows, and the top of the soil pipe after the oil was poured down. A strong southwesterly breeze was blowing at the time, which we hoped might drive the fumes of peppermint into the basement, if any opening existed from the sewer, or, if ordinarily there were any movement of the ground-air in that direction. The attendants in each ward were instructed to notice whether any smell of peppermint was perceivable about the fixtures, and immediately after the introduction of the peppermint into the sewer, the basements below the first and second wings, and also all the wards were visited, and afterward several times during the afternoon. No odor of the peppermint at any time was detected in the six wards of the second and third wings, nor outside over the line of the sewer, nor inside the basement, excepting at a single point in the continuity of the iron pipe from the bath-room. The Superintendent sent immediately for a plumber, and had the lead of the joints re-driven that same night.

Another cause which is operative in most outbreaks of diphtheria, and which is usually the most potent cause, and which undoubtedly has not been wholly inoperative in this one, is the direct or indirect

communication of the infection. In this hospital, in view of the untoward circumstances with which the Superintendent and his assistants have had to contend, could it have been possible to exclude all chances of it?

Drainage and plumbing, and the causative influence of any possible defects in the same. In the Third Annual Report of the State Board of Health, the Committee of the Board which inspected the Insane Hospital reported as follows:

"The improvements which the changes of the past few years have made in the second and third wings can be appreciated by comparing the present condition of their plumbing with that which still remains in the first wings. Particularly in the first wing on the female side the need of change is very urgent. The closets are of an antiquated pattern, and have long since ceased to be safe if they ever were, which is doubtful."

The condition of the wards in the first wing on both sides of the hospital was such that any enthusiastic believer in the theory that unsanitary conditions are an active etiological factor in diphtheria outbreaks, would have been ready to affirm that if diphtheria should be introduced into this institution the source of its most numerous victims would be in just these six wards in the first wings where the condition of the plumbing is so unsatisfactory. But the facts of the epidemic are far from conforming with what might have been expected. In the first wing on the male side, there have been but three cases, two in the lower ward and one in the upper, while on the female side there have been no cases among the patients and only a single one among the attendants,—the infection of which case was probably not received in the ward, but was contracted from another attendant who was attacked with the disease two days previously, and with whom she associated intimately. The duties of this attendant in the first wing were in the lower ward, the only one in which improvements have been made since the report of the inspection to which I have referred above.

From the foregoing survey of the history of the outbreak we think that we may safely draw the following conclusions:

That diphtheria was introduced into the hospital by an attendant who was just recovering from a "simple sore throat," but whose trouble was undoubtedly a mild form of diphtheria unrecognized in the absence of medical attendance.

That the prolongation of the outbreak illustrates the well known fact that the infection of diphtheria is exceedingly hard to "stamp out" in some localities.

That the prolongation of the outbreak in this particular locality has been due to several causes, among which that which introduced the disease has been prominent,—infection.

TYPHOID FEVER AT WASHBURN.

At the request of the local board of health, the Secretary visited Washburn Sept. 11. Typhoid fever had been quite prevalent in the village during the summer and fall months for several years. At the time of my visit there had been seven cases of typhoid fever, confined to the inhabitants of one particular quarter of the village. The part of the village in which the prevalence of the fever this year as in previous years, had principally fallen, was included within four short streets which form a small square. This small square is situated on a low triangular piece of ground between two branches of Salmon Brook. This ground is nearly level with a gentle slope in the direction of the confluence of the two branches. The question of the spread of the infection through the food or milk supply could easily be excluded. In most cases each family had its own cow.

The soil in this part of the village is gravelly with a sub-stratum of clay lying at depths of from six to twelve feet below the surface. I should judge from what I was able to learn that this stratum of clay is more nearly level than the surface with still probably a slight slope in the same direction with the surface inclination. While, therefore, the wells in the higher side of this square are twelve or fourteen feet deep, as we go down the slight slope we find those of lesser depth, ten feet, eight feet or even less, as in one well at least which was not stoned. The wells generally were dug only to the clay or slightly into it.

The common privy system is in use with shallow vaults excavated in the ground, or with no excavation at all. The house drainage is also all received on the surface of the ground. There was found, therefore, a condition of things which made it very easy for the water of these shallow wells to become polluted,—a porous gravelly

soil supported by an impervious stratum of clay which arrested all the downward soakage from privies, sink spouts, and other sources of surface pollution, and ran it into the wells. It appeared very probable, therefore, that the cause of the prevalence of typhoid fever in this particular part of the village was a repetition of the old story of polluted water.

The water supply of the other parts of the village is mostly drawn from deep wells,—wells which are drilled from sixty to eighty feet before a permanent water supply is reached. Before my visit, the local board of health had strongly advised and prohibited the people in the infected quarter from using the water from the shallow wells, and had instructed them to get their supply from the deep wells on the other side of the stream, and I think they were successful in convincing them of the danger which they pointed out.

Arrangements were made to have samples of water from the suspected wells sent to the laboratory of the State Board of Health for examination. When the samples were taken, however, rain heavy and continuous, had fallen, so there was but little prospect of learning from them what the usual condition of the water in these wells is, or what it was at the time when its use was the cause of the cases of fever, if, as is probable, it was.

The samples were collected Oct. 1st, 1888. The results of the chemical examination of the four samples were as follows:

No. of Sample.	Total Solids.	Loss on Ignition.	Hardness.	Chlorine.	Free Ammonia.	Organic Ammonia.	Nitrites.	Nitrates.
220	8.8	5.2	4.57	.8	.005	.009	Trace.	Trace.
221	21.0	14.0	7.43	1.0	.000	.008	H. Trace.	Much.
222	6.6	3.0	2.86	.8	.001	.008	Trace	Trace.
223	7.8	4.6	4.57	.5	.001	.009	None.	Trace.

These results though not so bad as might have been expected, do not under the circumstances lessen the probability that the outbreak was caused by infection of these shallow wells; nor would they remove the suspicion which attaches to them, even if the results indicated the condition of these waters at the time of, or just before

the outbreak. Repeatedly in the history of typhoid fever outbreaks the water which has undoubtedly been the source of the infection, has been found to be fairly good from the chemical point of view alone, but almost invariably the possibilities have been found for the admission at least of small quantities of fæcal matter or pathogenic germs which it might contain.

In analysis No. 220 the organic ammonia and the free ammonia are both in excess. In the other analyses there is more organic matter than is found in the best of well waters.

A sample of water from one of the deep drilled wells in the other part of the village, on the other side of the stream, received while this report is in preparation, gave the following results on analysis: Total solids, 27; loss on ignition, 13; hardness, 29; chlorine, 1.2; free ammonia, .001; organic ammonia, .003; nitrites, none; nitrates, much. The difference in the degree of hardness between this and the shallow wells is very marked.

Besides the visits and investigations which were made in connection with the events of which the foregoing gives a recital, visits have been made by the Secretary to the following places, in connection with his official duties: to Kennebunkport, in connection with an outbreak of scarlet fever; to Lincoln, to advise the local board of health in regard to a nuisance; to Greenville, in connection with an outbreak of diphtheria in a hotel; to Thomaston, with members of the Executive Council to examine the sewage pond, the old quarry in the yard, which receives most of the sewage of that institution; to Bath, to see the members of the local board of health; to Skowhegan, to consult with the Building Committee as to the ventilation of school buildings; to Norway, to advise with the local board of health about its local sanitary work; to Wiscasset, to advise with the Supervisor of Schools as to the ventilation of certain school-houses; to Derry, N. H., to consult with Prof. Angell, and to examine as to the workings of his sanitary closet; to Boston, in connection with matters of interest to the Board and to the Sanitary Inspector; to Saccarappa, several times alone or with Mr. Jordan, to advise in regard to the ventilation of school buildings, and other sanitary arrangements; to Lynn, Mass., to examine Dr. Pinkham's

plan for ventilating school-houses; to Topsham, at the call of the local board of health; to York Harbor and Beach, to consult with the local board in regard to sewerage and other improvements; to Sherman, at the request of the local board of health, to see what could be done with reference to the less objectionable disposal of the waste from a starch factory; to Oxford, to see about an outbreak of typhoid in a tenement house; to Biddeford, at the request of one of the physicians; to Milwaukee, as a delegate to the meeting of the American Public Health Association; (on return) to Chicago, to examine the ventilation of certain buildings; to Buffalo, N. Y., to examine the Fleischmann System of garbage extraction.

CIRCULAR No. 48.

STATE BOARD OF HEALTH OF MAINE.

TO THE SECRETARIES AND HEALTH OFFICERS OF LOCAL BOARDS OF HEALTH.

On Isolation of the Infectious Sick.

The need of this circular is suggested by occasional inquiries in regard to the isolation of infectious persons and households.

Excepting in the case of small-pox, by far the most important measures to prevent the spread of the infectious diseases are isolation and disinfection. Though it is theoretically possible that the poison of such infectious diseases as small-pox, diphtheria, and scarlet fever may be carried long distances in the air, it is certain that the nearer the infectious focus or centre, the greater the risk of infection. When once the germs of the disease have escaped into the outer air, they are immediately so diluted and borne away in the great mass of the external atmosphere, that the chances of infection from that source are very slight. It is, therefore, practically only in the confined air of infected rooms, or in the proximity to articles which have been exposed to such polluted air and saturated with the infection which it contains, that there is danger.

Hence, the necessity of excluding susceptible persons from the infectious sick-room atmosphere, and of guarding the public against the danger of the conveyance of the infection in the clothing or on the persons of those who have been exposed to this atmosphere.

No person has a right to communicate an infectious disease to his neighbor or his neighbor's child, and this truth is recognized by both

the common and statutory law. Morally and legally every person is bound, when an infectious disease is present in his own house or that of his neighbor, to observe those reasonable precautions which the law directs and which it is the duty of the local board of health to enforce when necessary.

But, in the execution of their duties, the spirit of the law, as well as its letter, should be kept in mind by the local boards. The greatest good of the greatest number is the purpose of the law. To avoid a common danger, the individual or the few are sometimes imperatively required to suffer a temporary inconvenience. But the duties of the local board do not cease with establishing isolation or quarantine. A humane consideration of the rights, and as far as possible of the interests, of the individual as against those of the many should be carefully considered.

The question, therefore, will often arise as regards the extent to which the severities of a rigid isolation may be mitigated without endangering the general safety. The answer to the question will depend, in the first place, upon the character of the disease with which we have to deal, and in the second place, upon considerations of expediency, urged by the various individual and local circumstances.

As regards the nature of the disease, if it is typhoid fever there will be no need of a strict isolation. In the well-ordered typhoid-fever room, the air is not charged with an infection which is capable of being transported in clothing and communicated to others. While, therefore, the person who comes to the infected premises and drinks the same water, eats the same food, and is subjected to the unsanitary conditions which may have been factors in the causation of the fever, may become infected, there is no danger in permitting the well members of the family to pursue their usual vocations and mingle with the public.

On the other hand, if small-pox appear, we have a disease to deal with which is infective, not only to the unprotected who come into its immediate presence, but to those who are brought into contact with persons and things that have acquired infectious qualities by exposure to the sick. In this disease, the quarantine should be absolute as regards the sick, the attendants, and the whole houshold; because, to the unprotected, small-pox is the most fatal malady of modern (perhaps of all) times; and this is so generally admitted, that the sentiment of the community, when the disease is recognized, will

sustain the local board of health in doing what is best for the general good.

In scarlet fever and diphtheria, we also have diseases which are communicable, either directly from the patient, or through infected clothing or other articles. It may also be said that since the practice of vaccination has become general, the sickness-rate and death-rate from either of these two diseases is a much more grevious burden than that from small-pox. Unfortunately, however, public sentiment does not always sustain the local board in carrying out those measures which would be best. Therefore the question of policy often arises, and it is asked: Just how far may considerations of expediency influence the local board in its treatment of scarlet fever and diphtheria? What *must* be done in all cases; what may be omitted in some?

Every case should be reported promptly to the local board as the law provides in Chapter 123, Laws of 1887, Section 10 and 13. This is absolutely necessary, and should, in every case, be insisted on. To make it as convenient as possible for him, every physician in this State has received from this office a supply of the blank, "Form 1," and, when more are needed, they may be obtained from the secretary of the local board, or from this office.

Every house in which a case of diphtheria or scarlet fever exists, should be placarded, the teachers of the schools in the neighborhood should be notified, and children from infected houses should strictly be excluded from school, Sabbath school, churches and all places where they would be liable to infect other persons.

After doing this, or receiving trustworthy assurances that it will be done, and having left with the family the appropriate preventable disease circular, the further management may depend upon the attending circumstances of the case.

Where a physician is in attendance, it is by all means desirable to have his co-operation. When he will give it, as he nearly always will, it is better to ask him to direct the family in regard to disinfection.

It will not always be necessary, and will often not be practicable, to confine the whole family to their premises. In country places there is no need whatever of restraining the movements of the members of the family on their own farm. In a crowded city or village there is more need of restraint, particularly of the younger members of the family. It is rarely, however, necessary to shut

absolutely the family within the walls of their own dwelling, and the necessity for this arises usually from their perversely ignoring the rights of others, and their refusal to observe reasonable precautions against spreading the infection. In such cases, it will sometimes be needed to place a guard over the house.

If the patient is isolated from the other members of the family within the infected house, these other members may safely be permitted more liberty than when all are exposed to the infection.

Shall the head of the family, the wage-earner, be permitted to attend to his work? This usually must of necessity be permitted, and generally with comparative safety, when his work does not bring him into close association with other persons, particularly with children. This privilege should not be granted, unless the patient or patients have a room to themselves, to which the person who is allowed the freedom has no admission.

The isolation of the infected household is in the interest of humanity, and should be effected in such a way as to cause the least possible hardship. When absolute quarantine is established, it is important that the local board should be mindful of the probable needs of the imprisoned family, and provide a method for supplying them with the necessaries of life.

To sum up in a few words, the purpose of the law is to protect the health and lives of the people. Whatever is necessary to accomplish this must be done, even though individuals occasionally suffer in consequence. But, in the enforcement of the law, all needless distress and annoyance must be avoided.

CIRCULAR NO. 50.

STATE BOARD OF HEALTH OF MAINE.

CONTAGIOUS DISEASES AND CONTAGION.

The past history of the prevalence of contagious and infectious diseases in our State, in common with that in other States, is substantially as follows:

One case or a few cases of diphtheria or scarlet fever appear in a family or a school. The origin may be importation, or it may be unknown. The first persons affected are not sufficiently secluded; the disease spreads to other pupils in the school, to other members of the same family, to other families, to a large part of the community or the town, to other towns, and the result in lives de-

stroyed, in suffering from illness, in watching and anxiety, in time lost and in money spent is sometimes appalling.

Fortunately the popular judgment is fast coming to recognize the fact that there is a human responsibility in these matters; that if infectious diseases are allowed to spread from their first points of appearance, somebody is to blame, the patient, friends, boards of health, the community at large.

It is a fact, which has been shown again and again in the experience of physicians, nurses and health officers, that those diseases which we call infectious or contagious, may be prevented and restricted, and that their spread and prevalence is in very close relationship to the amount of ignorance of this fact, or want of regard for it, which prevails in a community.

A person comes, therefore, naturally to be regarded as blameworthy, even criminal, who neglects or refuses to take those precautions, which are necessary to prevent the spread of infection from himself, or from those under his charge to others. The man who raises his hand against his fellowman with a weapon is held as a criminal under the law. Is it not also criminal needlessly to expose others to the poison of a dangerous disease, which he carries, or probably carries in his person or clothing? Jurists have answered as follows:

"If a man, conscious that he carries about with him the germs of a contagious disease, recklessly exposes the life and health of others, he is a public nuisance and a criminal, and may be held answerable for the results of his conduct. If death occurs through his recklessness, he may be indicted for manslaughter. It is held that where a man knowingly communicates a contagious disease to another and death results, the crime is that of manslaughter. The man may be indicted also for spreading the disease by conscious exposure of others thereto, by his presence in public places, such as on the streets, in halls, etc."—*Judge Dixon, of New Jersey.*

We feel certain that every good citizen also will answer "yes," and be willing, when, at rare intervals, he or those under his charge suffer from contagious diseases, to take pains that no careless act of his may be the possible death-sentence of some other person.

Contagious diseases can be kept from spreading. The law of our State recognizes this fact, and wisely makes the following provisions:

1. That "whenever any householder knows or has reason to believe that any person within his family or household has small-pox, diphtheria, or scarlet fever, cholera, typhus or typhoid fever, he

shall within twenty-four hours give notice thereof" to the health officer, when there is one, otherwise to the secretary of the local board of health. The same duty also devolves upon the physician when one is in attendance.

2. That the local board of health shall immediately notify the teachers in the neighborhood where cases of the infectious diseases have occurred, and it becomes the duty of the teacher to exclude from the school-house pupils and other persons from the infected house or houses.

3. That the patient shall be isolated. The power is conferred upon the local board, and the law makes it its duty to require the isolation of all persons and things that are tainted with, or have been exposed to, contagious or infectious diseases.

4. That the public shall be notified of infected places by the display of red flags or placards at the entrances of the premises.

5. That disinfection of all infected places and things shall be carried out in accordance with the instructions of the local board of health or the attending physician.

6. That house-holders or parents shall not permit infectious persons, clothing or other things to be removed from the house without the permission of the local board of health or attending physician.

7. That "no parent, guardian, or other person shall carelessly carry about children or others affected with infectious diseases, or knowingly or willfully introduce infectious persons into other persons' houses, or permit such children under his care, to attend any school, theatre, church or any public place."

8. That "no person affected with small-pox, scarlet fever, diphtheria or cholera, and no person having access to any person affected with any of the said diseases shall mingle with the general public, until such sanitary precautions as may be prescribed by the local board or the attending physician, shall have been complied with.

9. That persons recovering from infectious diseases, and nurses who have been in attendance on persons suffering from any such diseases, shall not leave the infected premises until they have taken such precautions as are necessary to prevent the carrying of infection.

10. That no person shall give, lend, transmit, sell or expose, any bedding, clothing, or other article, likely to convey infection, without first taking such precautions as the local board of health may direct for removing the danger.

The legal obligations, therefore, of the individual as regards the contagious diseases may be summarized as:

Notification of the local board.

Isolation of the patient and of infectious things.

Disinfection of persons, clothing, rooms and other things which have become infected.

It is very important that all cases of the infectious diseases be reported early. The local board will then be able to satisfy them-

selves either by a personal conference with the house-holder, or with the attending physician, that the family and attendants understand the proper methods of preventing the spreading of the disease.

From the local board of health circulars may be had, which give instructions in regard to the principal contagious diseases, and the best means for preventing their dissemination. When epidemic or infectious diseases threatened to spread, these tracts should be circulated broad-cast in the community, and for this purpose the needed number of copies may be obtained of the local board of health, or directly from the State Board, by sending a postal card to the Secretary, at Augusta.

The good effect of the distribution of these circulars has been very apparent in the immediate limitation of outbreaks as soon as the community has obtained a clear understanding of the exact nature of the danger, and the best methods of meeting it.

Isolation. At the earliest possible moment after the contagiousness of the case is suspected, the patient should be put into a room in which he will be isolated from the rest of the family, and where he will be attended by the physician, and only such other persons as are absolutely necessary, all of whom should take special care not to distribute the infection.

When the parents act as nurses, it is manifestly improper that either of them should at the same time mingle freely with the general public. Only those members of the family, who do not have access to the sick ones, can with safety to the public go at liberty; and even then they should avoid as much as possible going into public assemblages, especially where there are children.

When possible, it is better to have the sick chamber on the upper floor. Before the patient is moved into it, every thing should be removed which is not essential to his comfort. It should be borne in mind that the fewer things there are in the room, the less will be the work of disinfecting and cleaning up: for everything that remains must subsequently be disinfected.

The strictness of the required *isolation* will depend upon the character of the disease.

Typhoid Fever is only in slight degree infectious directly from the patient to others. The infectious material exists only in the discharges from the patient: and, if these are promptly and properly disposed of, there is but little danger in the sick room. The

discharges should be thoroughly disinfected, and not thrown into the privy vault, or where they may pollute the ground around human habitations, or find their way by surface wash or soakage into any well, spring, or water-course, which serves as a drinking water supply. (See Typhoid Fever Circular.)

Small-pox, Diphtheria, and Scarlet Fever, on the other hand, are communicable directly from the patient to others. The infection is given off in the breath, from the whole body, and the discharges are undoubtedly infectious in all. The contagion of each of these three diseases is doubly dangerous for the reason that its vitality (its infectiousness) is often preserved for a long time. That is, rooms, clothing, and other things, which have become contaminated may retain their infectiousness for months or even years, unless the contagion is destroyed by disinfection. (see circulars on *Is Diphtheria Contagious? Small Pox, Diphtheria*, and *Scarlet Fever.*)

Disinfection. We know the essential cause of some infectious diseases consists in a microscopic organism, and we have good reason to surmise that all of them are dependent on similar living particles. These micro-organisms or germs are hard to kill. A slight fumigation with sulphur or chlorine would quickly kill a man; but, though continued for hours, would be entirely harmless to these disease germs. It is necessary then entirely to disregard old traditions, and to use only those disinfecting agents and methods which both experience and the latest investigations have shown to be trustworthy destroyers of infection.

Burning will destroy infection, and should be employed in the case of all worthless articles.

Boiling in water for half an hour will disinfect all things which can be so treated. Boiling water in excess may also be used for disinfecting infectious sputa, and excreta in closed vessels.

Steam under slight pressure or freely streaming through the articles can be used on the larger scale for disinfecting bedding, clothing or other things which cannot be boiled. For this purpose special disinfectors are required.

Chloride of Lime in solution, six ounces to the gallon of water, is one of the best of disinfectants for infectious sputa, excreta, privy vaults, etc. It injures clothing.

Corrosive Sublimate (very poisonous if swallowed) is one of the surest of disinfectants for many purposes. Its use should always be under the direction of some intelligent and careful person. In solution, about one drachm to the gallon of water, it is the most desirable disinfectant for washing walls, floors, and all the wood work of furniture. Clothes may also be soaked in this solution until they can be washed.

Carbolic Acid, (seven ounces to one gallon of water), is a good disinfectant for clothing until it can be boiled. It does very well also for sputa, excreta in general, and some other purposes. It is more costly than, and upon the whole not so efficient as Chloride of Lime and Corrosive Sublimate, for the purposes for which they have been recommended.

Fumigation with Sulphur is a useful auxiliary, but should not be depended upon alone. To disinfect a room ten feet in each dimension, three pounds of sulphur should be burned.

All disinfectants require time to act. When matter is to be disinfected, it is almost useless to dash it with a disinfecting solution and immediately pour it into the vault. The matter or things to be disinfected should remain subjected to the action of the disinfectant quite a long time, several hours, if possible. See *Circular No. 38, Disinfectants*, or directions for their use, on last page of each preventable disease circular.)

One hundred thousand or more persons die annually in our nation from diseases which are clearly preventable, and a large part of this excessive mortality is due to the contagious diseases. In no other way can a person be more truly a public benefactor than by contributing his mite of care, and in using his influence to stay the unnecessary slaughter. He who thoughtlessly spreads infection, or allows it to be spread, needs to be taught; he who wilfully does so, richly deserves the penalties of the law.

NEW ACT.

The following new act providing for the more prompt reporting of cases of infectious diseases and empowering the State Board of Health to appoint Local Boards of Health, or fill vacancies in such Boards in case the municipal officers fail to make the appointments, was passed by the Legislature of 1889.

Chapter 227.

AN ACT in relation to Local Boards of Health, additional to chapter one hundred and twenty-three of the Public Laws of eighteen hundred and eighty-seven.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

SECTION 1. If the municipal officers of any city or town shall fail to appoint a local board of health or to fill any vacancy in said board, in accordance with the provisions of section two of chapter one hundred and twenty-three of the public laws of eighteen hun-

dred and eighty-seven, the secretary of the State Board of Health may in writing request such municipal officers to make such appointment, and if the municipal officer shall neglect or refuse to do so for a period of thirty days after receiving such written request, the State Board of Health may appoint such local board of health, or fill any vacancy thereon.

SECTION 2. It shall be the duty of the secretary or health officer of each local board of health in this State, who shall have knowledge of any violation of the provisions of section thirteen, of chapter one hundred and twenty-three of the public laws of eighteen hundred and eighty-seven, occurring within the jurisdiction of such local board of health, to forthwith give notice thereof in writing and of all facts within his knowledge in relation thereto, to the county attorney of the county in which such violation has occurred and said county attorney shall thereupon examine into the case and take such action in the matter as the circumstances of the case require.

(Approved February 26, 1889.)

WATER ANALYSIS.

In the fall of 1887 a laboratory for the sanitary examination of samples of water was opened in connection with the office of the State Board of Health, and analyses of sixty-four samples, mostly of private water supplies, were made. During the year 1888, the work in the laboratory has been continued, directed in great part to a study of the character of our public water supplies. Altogether, during the year, 227 samples have been examined chemically, of which 109 were samples from the various public supplies, 90 were of well waters, 14 were from springs, 3 from cisterns, and 11 from various other sources. In three instances, analyses have been made as a help in determining the suitability of proposed sources as public water supplies, and in several others, examinations have been made for citizens of our State to aid them in the selection of suitable waters for introduction as private supplies.

This is but a small beginning of the work which should be carried on in this direction for many years. There is hardly another subject coming within the sphere of duty of the public health officer more important than the investigation of the character of the public and private supplies of drinking water within his jurisdiction, and the

taking of measures to ensure the absence of danger in connection with them. To determine definitely the character of a water supply public or private, something more than a single analysis in the chemical laboratory is needed. One reason for this is that but few sources of supply are free from quite wide seasonal fluctuations as regards chemical composition, therefore the results of a single analysis would be likely to be misleading if taken as representing the constant or usual condition of a water. For instance, the results of the analyses of some well waters, made in the autumn gave results which were better than would naturally have been expected, considering the injudicious location of the wells. This was undoubtedly due to the fact that the very heavy fall rains had unduly raised the ground water and limited the area of the ground surface which was drained by these wells.

There are still other reasons why it is desirable to have the examination of our water supplies extended to all parts of the State and cover a considerable period of time. As far as relates to the chemical examination, the estimation of the character of a given sample of water is made from the determination of the quantity of certain contents which are rarely entirely absent in even the purest of natural waters, hence the problem is, not merely to determine the presence of an unwholesome something in the water, but to estimate quantitatively its constituents, and from that estimation to judge whether any of the contents are in a harmful quantity, or rather, and more frequently, the problem is to determine whether those matters for which we examine are in excess of the normal amount for the given class of water and the locality.

For instance, chlorine, existing largely in the form of chloride of sodium, or common salt, is one of the substances, the estimation of which is always an important step in the chemical analysis of water for sanitary purposes. Chlorine is found in all natural waters, derived, if from no other source, from the geologic formation. and from the air, and varying in quantity, therefore, with the chemical composition of the soil and the proximity to the sea.

The question, then, in connection with the chlorine estimation is whether the quantity which has been found is in excess of that which normally pertains to the locality. The mere fact that it is found in large quantity has no sanitary significance, provided we can be assured that the chlorine is derived naturally from the peculiarities of the soil in the given locality. But in our State, with

few known exceptions, a large chlorine contents is not derived naturally from the ground, but may be taken as strong presumptive evidence of abnormal conditions and suggests the presence of a danger,—that is of pollution.

Chlorine in common salt is universally and plentifully used as an addition to human food, and consequently all human excretions and all sewage contain it in large quantities, and experience has shown that when drinking water contains much chlorine, the excess is almost invariably due to the admixture of sewage with the water; and by sewage is meant, not only the fouled liquids which flow from sewers, but the soakage from privy vaults, cesspools and the like.

It may, therefore, easily be inferred that a knowledge of what is usually found in the naturally good water of a district is an important element in making up a judgment as to the character of a given sample from that locality, and this is one of the purposes of the Board; to gather data as rapidly as possible for the fixing of norms for all parts of the State, not for chlorine alone, but for all those constituents which are shown in the following reports of analyses.

Methods of Estimating the Character of a Water. We have seen that something is needed in the estimation of the character of a water further than the knowledge which is furnished by the single chemical analysis, and we further say that the time has gone by when the intelligent chemist would wish to pronounce positively on the character of a water from his laboratory results alone.

Chemistry estimates very accurately the quantities of some of the matters which are the object of its search, as regards some of them, even one part in many millions, yet the chemist gets but little positive information from his manipulations in the laboratory of the *origin* of what he finds. For instance, in our Maine rivers, 0.014 part of organic ammonia would be considered as well within the norm for that class of waters, but the same amount in a well water would be strong presumptive evidence of pollution. It is, therefore, necessary, if the chemist would give a trustworthy opinion, to go beyond his chemical results, and learn something of the origin of his samples of water and about the possible sources of pollution. For this reason, a history of the sample of water is always required, as a help in interpreting the meaning of the chemical results, and it is particularly needed in the third of the following classes of samples.

All waters, as regards the results of their analyses may be arranged in three classes:

Class first includes those of which the results of the analyses are so favorable that there can be no doubt whatever that they are *chemically* pure.

In *class two*, the results are so unfavorable that there can be no doubt that the waters are wholly unfit for use as drinking waters.

In *class three*, the doubtful class, the results are neither good enough nor bad enough to warrant a positive opinion. In these, the most that can be said is that the waters are to be regarded with suspicion.

In the last class of waters a careful study of the location and surroundings of the well or other source of supply is of the utmost importance, as probably supplying information which is needed to show whether the suspicions are well founded or not; in fact, in many cases, an intelligent inspection of the source of supply is of greater worth even than a chemical examination. For instance, a well located only twenty feet from a privy vault, may furnish a a water which chemically is not bad, but, nevertheless, the results of the analysis, or of a series of favorable analyses, would not justify the opinion that the drinking of the water from a well thus located is devoid of danger, for experience has shown that so limited a thickness of intervening soil cannot be trusted as a permanent destroyer or arrester of the organic matter which percolates through it. Around privies and cess-pools the line of polluted soil gradually widens, and though an analysis may show that, at the present time, the filth has not yet reached the neighboring well, in twelve months, one month, or even next week, it may.

Furthermore, experience has shown that a water may be chemically good, and nevertheless dangerously infected, and a brief consideration of some of the mechanical, chemical and biological processes which go on in the soil, will make it clear how this may be so.

Ordinarily, in percolating downward through the soil, water not only has most of the solid particles which it may contain strained or filtered out mechanically, but its contained organic, or at least its dead organic matter undergoes chemical changes, in that the ammonia which is evolved in the process of decomposition, is oxidized in the presence of the ground-air, and thereby converted into nitrites, and by a further oxidation, the nitrites are changed

into nitrates. This ultimate product of these transformations, the nitrates, are entirely harmless and are to be regarded with suspicion only as indicating sources of pollution somewhat remote, and the possibility that the intervening soil-barrier may not always prove so efficient a filter, or depurator, as at present.

These oxidizing processes which take place in the soil, were formerly supposed to be purely chemical transformations, but it is now generally conceded by scientists that they occur through the agency of micro-organisms.

As regards the dead organic matter (as existing in sewage, for example) we know that a sufficient depth of soil filtration under normal conditions, may be trusted to remove it or convert it into harmless products, but we are not quite so sure of its power to arrest that most dangerous element of sewage, that is, infective matter or disease germs. These, on account of their extremely minute size, even among microscopic things, may elude the mechanical arrestation which befalls all the solid particles, and by their endowment with vital properties, they may successfully resist the destructive chemico-biological processes to which we have alluded. With a capability of living and even multiplying in the soil and in water, as recent experimental work renders very probable, we may readily conceive how a very few microbes transferred to a well or other water supply through the soil, or otherwise, may, under favorable conditions, render the whole infective, while still chemistry does not detect an excess of those contents which are generally regarded as indices of danger.

Thus it is apparent how it often happens, as it apparently did in Washburn, that water may be infectious, and yet not notably bad chemically.

As regards the appreciation of the significance of the figures which express the results of chemical analyses, the following will undoubtedly be helpful to the general reader:

Total Solids. The total solids consist of the residue of solids which is left after the evaporation over the water-bath, of a measured quantity of water. It consists of both the inorganic constituents which are dissolved in the water, and the organic matter. Though generally it is desirable to find the total solids low, the mere quantity cannot be said to have a decided sanitary significance unless it is very large. In the samples examined from the public

water supplies, the total solids have ranged from 1.2 to 17.4 parts in 100,000, and the maximum figure is found in the water from an Aroostook stream, which issues from a limestone soil. The solids in this instance consist mostly of carbonate of lime which imparts a hardness to the water, but which from a sanitary point of view is probably not objectionable. Among the other analyses contained in this report, the lowest total solids, 1.8, was found in analysis No. 68, a well in North Yarmouth, and the highest, 83, in No. 160, a deep well in Portland, and in the latter, the further results of the analysis show that the organic matter could have been but a small element in the composition of the total solids.

Loss on Ignition. After drying, and weighing the platinum dish to obtain the amount of the total solids, it is exposed to the Bunsen flame and brought to a dull red heat, thereby burning and driving off the organic matter, and dissipating as well some of the volatile inorganic constituents of the total solids. A second weighing shows the "loss on ignition," and though this does not stand in a very constant relation to the amount of organic matter, the process is of some value, especially when considered in conjunction with the phenomena of ignition.

Hardness. The degree of hardness of a water is usually more of an economic than a hygienic question. A hard water is very unsatisfactory for many household and industrial uses, but there is no certainty that moderately hard waters are unwholesome for drinking purposes; in fact, many authorities claim that there is a sanitary advantage in a moderate degree of hardness. Pond and river waters are generally softer than spring waters. The degree of hardness of most of the lake, pond and river waters which have been examined ranges from 1.5 to 3 parts in 100,000. Among the public supplies, the hardest waters are found in Aroostook, but the hardest of these may probably be said to come well within the limit of waters which we may describe as "moderately hard."

Among the miscellaneous analyses tabulated further on, the degree of hardness of the springs has ranged from .79, in Nos. 89 and 217, to 19.60 in No. 146; and of wells, from .95, in No. 120, to 39.20, in Nos. 136 and 251.

The analyses which have been made, indicate, what might have been inferred from the known geologic formation, that there are at least two tracts in the state in which the water, particularly of the wells and springs, is very hard,—the limestone region of the Arook-

took valley, and that tract of limestone formation which extends along a part of our coast from Thomaston to Castine.

Chlorine. The results of the laboratory work, as far as it has now progressed, indicates that almost everywhere in the State, the proportion of chlorine in the normal waters is quite low. The average amount of chlorine in 29 analyses of public waters which are taken from lakes and ponds is .38 ; for the 35 samples of public supplies from rivers and streams the average is .25 ; for 16 samples from four public supplies which are taken from brooks "fed by springs" it is .28 ; and for 15 samples of four public supplies, taking their source from springs, it was .05 ; part per 100.000. In 41 analyses of samples from wells and springs in which, from the further results of the analysis and the history of the surroundings we could pretty confidently exclude the influence of pollution, the average chlorine was .63. Examples of large amounts of chlorine were 12.6, found in No. 147 ; 11.2, in No. 160 ; 17.56, in No. 210 ; 19. 6, in No. 212 and 11.8, in No. 225. In deep well and spring waters we sometimes find much chlorine which the further results of the analysis do not permit us to refer to sewage or other pollution. In shallow wells, and those of ordinary depth, in most parts of the State 2 parts per one hundred thousand may undoubtedly be regarded as sufficient to excite suspicions of pollution, but a well water is not to be condemned, even when it contains a considerably larger quantity of chlorine, uuless the suspicion is confirmed by the other analytical processes, or the history of the surroundings of the well.

Free Ammonia. Organic matter in process of decomposition may be considered as almost exclusively the source of the free ammonia in waters, at least in this State. Good well and spring waters should contain not more than .001 or .002 part of free ammonia, and when exceeding the latter quantity, an investigation should be made as to its origin. In river and lake water we cannot attach so positive a signification to the free ammonia element ; its quantity varies much with the weather, atmospheric precipitation sometimes increasing it markedly.

In the samples of public water supplies from lakes and ponds the average amount of free ammonia is .001 ; and in those from rivers and streams .0013 is the average. Among the miscellaneous analyses the quantity has varied from .000 in Nos. 68, 96, 122, 126, 146, 236 to 1.308 in No. 66 from a well close to a barnyard and highly polluted, though colorless.

Organic Ammonia. The organic or albuminoid ammonia is derived from the more stable organic matter which is broken up and converted into ammonia by the chemical process which is employed. The best of spring and well waters which have been subjected to an efficient filtration through the soil, show but little organic ammonia. In well waters, more than .006 or .007 part should cause suspicion of organic pollution, and the larger the excess, the stronger becomes the evidence against the water. In lakes and ponds a larger quantity of organic ammonia is found than is usual in good spring and well waters, and in rivers still a higher proportion seems to be a normal condition, irrespective of artificial pollution. The average of the organic ammonia in the water supplies from lakes and ponds which we have examined is .0102; in the river supplies it is .0167. Among the miscellaneous samples received, it has ranged from .000 to .151 (sample 136). In the latter instance the well was polluted with soakage from the barn-yard.

Nitrites and Nitrates. The nitrates are to be considered as the ultimate stage in the reversion of organic into in-organic matter, while ammonia is the first step and the nitrites an intermediate one. Thus from the decomposition and oxidation of organic matter we have in the usual order of their sequence, ammonia, nitrites and nitrates. The sanitary significance of these three products diminishes in proportion to their removal from the beginning of the series of transformations. Thus, an excess of free ammonia is generally regarded as indicative of decomposing organic matter in or near the source of water supply, while an excess of nitrates might originate from the decomposition of organic matter at some distance from the point where the sample was taken, and the products of which had undergone a higher oxidation in their filtration through the soil. The presence of nitrates and especially nitrites suggests the possibility that the time may come when the soil will cease to do its depurating work so thoroughly, or even that, with its present capacities, it may be unable to filter out the infective principles which may, at any time, become an accompaniment of the organic filth.

In conclusion we would say that no judgment should be passed on a water from the results of a single chemical process, but the evidence which is given by one should be strengthened or corrected by that which is furnished by the others. In many cases the evidence which is furnished by the microscope will determine

whether the verdict shall be for or against the water, and in all cases the results are to be interpreted in the light of the history of the origin of the sample.

PUBLIC WATER SUPPLIES.

In the beginning of the year letters were sent to the various water companies, as far as they were known in this office, inviting them to coöperate with the Board by sending samples of water from their respective supplies for examination at stated intervals during the year 1888. Without exception the replies which were received indicated an entire willingness to do so. From two water companies only, no response was received, and in one of these cases we are not sure that the hesitancy was due to a desire not to send the samples. In this connection we wish to thank most sincerely all those persons who have lent their aid in this direction, whether officers or employes of the water companies, or members of the local boards of health.

The tabulated results of the analyses of each supply will be found arranged in alphabetical order, according to the name of the town, city or village which is supplied. The results, with the exception of nitrites and nitrates are recorded in parts per 100,000. To change into grains per U. S. gallon, multiply by .58372, or to change into grains per imperial gallon, multiply by .7.

In getting the averages for free ammonia and organic ammonia, the fourth decimals were added in.

At the end of the reports on public water supplies, a note will be found of the instances in which the nitrites or nitrates amounted to more than a trace.

AUBURN.

The Auburn Aqueduct Company takes its supply from Lake Auburn, otherwise known as Wilson Pond, a sheet of water about four miles long and two miles wide, and including in its surface about six square miles. The water is brought three miles. The watershed is comparatively small, and as the outlet is much larger than the visible inlets it is thought that the pond is supplied largely by springs. The pond stands always at nearly the same level. The watershed is of granitic formation, sparsely settled and mostly uncultivated pasture land. The supply is at all times abundant.

The distribution is principally by gravity with a small iron reservoir for high service. Iron pipes are used for both the main and distribution systems. The company was organized in 1869 and began taking water from the pond in 1880. The designing engineer was F. M. Jordan. F. M. Jordan, President and Superintendent, N. I. Jordan, Secretary.

The samples were all taken from the tap in the house of the Superintendent.

No of analysis.	Date of collection.	Total solids.	Loss on ignition	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
90	February 27..	2.0	1.4	1.95	.4	.002	.009
112	May 4	2.6	1.8	1.69	.3	.001	.018
143	June 18	2.6	1.8	1·56	.3	.000	.010
186	August 30....	2.8	2.2	1.69	.4	.000	.011
245	October 29....	3.	1.8	1.27	.2	.000	.009
279	December 18..	2.4	1.2	1.69	.1	.000	.008
Averages........		2.5	1.7	1.64	.25	.0007	.0111

AUGUSTA.

The Augusta Water Works takes its supply from the Kennebec river just above the Edwards Manufacturing Company's mills, where its pumping station is located. The water is pumped to a reservoir of the capacity of 8,000,000 gallons, situated on Burnt Hill, whence the distribution to the city is by gravity. The water in the reservoir is held 290 feet above Water street, giving a pressure of 125 pounds to the inch. The water is filtered through a Warren filter.

There are now laid and in use 6,839 feet of 12-inch pipe; 1,443 feet of 10-inch pipe; 59,589 feet of 8-inch pipe; 44,698 feet of 6-inch pipe; 9,616 feet of 2-inch pipe; 5,295 feet of 1-inch pipe. There are 80 city hydrants; 12 private hydrants. The company began supplying water in June, 1887. The designing engineer was J. Herbert Shedd. George P. Wescott, President; Wm. H. Williams, Superintendent.

The samples were all taken from the tap at the laboratory in the State House.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
75	February 1...	4.2	2.8	3.25	.4	.002	.016
107	April 27......	3.6	2.0	1.95	.2	.000	.015
119	May 17........	4.0	1.8	1.27	.2	.003	.021
131	June 7........	3.4	2.4	1.56	.3	.000	.013
289	December 31..	3.6	1.8	1.95	.04	.000	.010
Averages........		3.7	2.1	1.99	.2	.0012	.0152

Augusta.—Devine Water Company.

This company furnishes a limited supply of water taken from artificial springs or filtering galleries over the hill about three-quarters of a mile west of the State House. Only one analysis of this water has been made. The following were the results: No. of analysis, 142; date of collection, June 18; total solids, 8.4; loss on ignition, 3.6; hardness, 5.29; chlorine, .4; free ammonia, .000; organic ammonia, .003.

Bangor.

The water supply of the city is taken from the Penobscot river about a mile above the city and from the opposite side of the river. The water is distributed by direct pumping by the Holly system. Filtration, or rather straining, the supply is effected by passing it through two feet of gravel. The main pipes are of cast iron and the distribution service is through galvanized iron pipes. The designing engineer was L. H. Eaton and the water supply began Jan. 1, 1876. The water supply is under the direction of the city Water Board with the Mayor as Chairman. G. W. Snow, Secretary; F. E. Sparks, Superintendent.

The samples were all taken from a tap near the center of the city.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
84	February 17..	4.6	3.0	1.95	.3	.000	.015
248	October 29....	4.4	3.2	1.95	.1	.000	.019
275	December 17..	4.4	2.0	1.69	.1	.001	.021
Averages.......		4.4	2.7	1.86	.16	.0003	.0183

BATH WATER SUPPLY CO.

The supply is taken at a point near Harding's Station about four miles from the city, or nearly midway on the sandy plains between Bath and Brunswick. At the place selected as the source of supply, water had oozed out from the ground making it somewhat springy and this water, confined by the embankments of the Maine Central Railroad, had created a small pond. The ground and the groundwater beneath this pond were made the source of supply for the city of Bath. Collecting pipes fifteen inches in diameter were laid in the sandy soil eighteen feet beneath this pond, and laterals of smaller size supplied them.

The watershed is about six square miles. The water is pumped into a stand pipe. Iron pipe is used for main and distribution systems. The supply of water began Sept. 1, 1887. J. Herbert Shedd was the designing engineer. C. H. Payson, President; J. C. How, Superintendent.

The sample of Nov. 6, was taken from the surface pond which lies over the source of water supply. The sample of June 20, was taken from the well at the pumping station; all other samples were taken from a tap in the office of the water company.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
65	January 1....	3.	1.4	1.95	.6	.000	.003
105	April 24......	3.2	1.	1.56	.6	.003	.008
145	June 20	3.2	1.	.95	.4	.000	.000
191	September 4 ..	3.8	1.6	1.69	.6	.001	.010
259	November 6...	10.2	5.4	2.86	2.8	.086	.120
269	December 4...	3.6	1.	1.69	.4	.000	.002
Averages........		4.5	1.9	1.77	.9	.0012	.0049

In getting the averages of the above, the results of the examination of the sample of Nov. 6 were excluded.

Bar Harbor.

The Bar Harbor water supply is taken from Eagle Lake, a sheet of water about two miles in length and one mile in width, and elevated about two hundred feet above mean high tide. The lake is mostly surrounded by hard wood growth, and there are but two houses near the lake. The head of the lake and one side are mountainous. These facts were communicated by the Secretary of the local board of health; the samples were sent by the water company.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
79	February 7...	3.0	1.2	1.27	1.0	.001	.003
104	April 23......	1.8	1.4	.48	.8	.001	.010
161	July 14.......	2.6	2.0	.79	.8	.002	.010
Averages........		2.4	1.5	.84	.86	.0016	.0081

Belfast Water Company.

The source of the supply is from an artificial pond on Cole's Brook which is stated to be fed by a spring. The pond has an extent of forty-five acres. The watershed consists of about four thousand acres, the most of which is rocky, and covered with a slight hard wood growth. Very little of it is under cultivation. The supply is at all times abundant. The water is brought two miles and a half and is pumped into a stand-pipe. Iron pipes are used both for main and distributions. The supply was turned on Dec. 1st, 1887. Charles F. Parks was the designing engineer. Charles J. Gilman, President, Brunswick; Elbert Wheeler, Secretary, Boston, Mass.; Charles Baker, Superintendent, Belfast.

The samples were all taken from the pond.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
85	February 17..	3.4	1.6	1.95	.8	.000	.006
110	April 30......	3.0	2.2	1.56	.4	.000	.014
148	June 24......	4.6	4.4	1.56	.4	.001	.016
241	October 16....	3.8	1.6	1.11	.36	.003	.015
277	December 16..	2.4	1.0	.95	.4	.000	.007
Averages........		3.4	2.1	1.42	.47	.0010	.0118

Biddeford and Saco Water Company.

The water which is supplied by this company is taken from the Saco River at a point about two miles above the points of distribution. The watershed is largely cultivated land. The water is pumped to a reservoir of 10,000,000 gallons capacity, whence it is distributed. Filtration is effected with fine and coarse gravel. The material for the main pipes is cast iron, while the distribution system consists of galvanized iron pipes. The supply was first turned on, Jan. 1st, 1885. J. Herbert Shedd was the designing engineer. D. W. Clark, President; George West, Secretary; James Burnie, Superintendent.

The samples were all taken from a tap in the office of the company.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
81	February 13 ..	3.2	1.6	1.27	.4	.000	.007
99	April 19......	3.2	1.6	1.27	.3	.000	.013
128	June 4........	3.	1.4	1.27	.3	.000	.015
173	August 10....	2.8	1.	1.27	.2	.000	.010
228	October 12....	3.2	2.8	.48	.2	.000	.021
272	December 14..	1.8	.6	.95	.16	.000	.009
Averages........		2.8	1.5	1.08	.26	.0001	.0128

BOOTHBAY.

This town has no water supply, but there is a move in that direction. Analyses have been made of samples from several proposed sources and the results are tabulated below. The examinations made are too limited as to season and number to permit of any positive opinion as to the suitability of the proposed sources.

No. of sample.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
87	February 21 ..	2.4	1.8	.48	.6	.003	.011
88	February 21 ..	2.4	1.4	.48	.8	.004	.011
89	February 21 ..	2.0	1.4	.79	.7	.003	.008
285	December 25..	4.2	1.6	1.95	.56	.001	.007

No. 87 was from Adams Pond, No. 88 from Lewis Pond and Nos. 89 and 285 were from Auld Spring.

BRUNSWICK,—PEJEPSCOT WATER CO.

Water was first distributed by this company in December 1886, the supply then being taken from the Androscoggin river about a

mile above the village. A change was made in the summer of 1888, and the supply is now taken from an artificial reservoir on a brook which is said to be fed by springs. The point of intake is 9200 feet from the village. But one house is situated on the watershed and that has been furnished with a suitable sewerage pipe, running 400 feet. The water is distributed from a stand-pipe, and is filtered through Warren's patent filter. The supply is said to be adequate for all purposes. Cast iron is used for the main pipes and galvanized iron for the service pipes. The designing engineer was J. Herbert Shedd. S. J. Young, President; George F. West, Secretary; I. H. Simpson, Superintendent.

All the samples were taken from a tap in the company's office.

The first three samples were taken from the old source of supply and the last three from the new.

No. of analysis.	Date of collection.	Total solids.	Loss on Ignition.	Hardness.	Chlorine	Free ammonia.	Organic ammonia.
78	February 7....	4.6	2.2	2.60	.4	.020	.022
103	April 23......	3.8	2.	1.95	.6	.000	.008
140	June 14......	3.	1 8	1.56	.2	.003	.015
Averages.......		3.8	2.0	2.03	.4	.008	.0153
185	August 27 ..	10.0	7.4	2.60	.6	.000	.001
267	November 15..	2.6	1.2	.95	.36	.000	.007
281	December 21..	2.8	1.0	1.27	.36	.001	.010
Averages........		5.1	3.2	1.60	.44	.0005	.0061

CALAIS WATER COMPANY.

The source of the supply is from the St. Croix River and its lake system. The intake is from the river above Calais and Milltown, at a distance of about 160 feet from the shore. The water is pumped into a three million gallon reservoir, and then distributed by gravity. Pumping for two days in the week suffices to keep up the supply. The watershed is largely uninhabited, and is covered with a soft wood forest growth. Above the intake there are only the two small villages of Baring and Princeton, and these have no sewerage system. No filtration of the water is employed excepting

straining through broken stone and wire screens to keep out the sawdust. The main pipes are cast iron, and the distribution service is through tarred iron pipes. The water was turned on in December, 1886. M. M. Tidd, Boston, was the designing engineer. Weston Lewis, President; J. S. Maxcy, Secretary and Treasurer; Willis E. McAllister, Superintendent.

The samples were all taken from the tap in connection with the pump while the pump was doing regular work.

No. of analysis	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
92	February 28 ..	3.2	2.0	1.43	.4	.000	.019
106	April 24......	3.2	2.0	1.27	.4	.000	.025
149	June 26......	3.0	2.0	1.95	.2	.001	.016
198	September 11..	4.0	3.2	1.27	.4	.000	.024
261	November 7 ..	4.2	3.8	1.69	.2	.000	.029
282	December 24..	4.0	2.4	1.95	.04	.001	.019
Averages........		3.6	2.5	1.59	.27	.0005	.0208

Fryeburg Water Company.

The supply is taken from White Lot Brooks in Conway, N. H., three or four miles from the points of distribution. The intake is from an artificial pond or reservoir which is held by a dam. The capacity of the reservoir is only 40,000 gallons, but it will fill in thirty minutes after being emptied. The supply, therefore, is at all times abundant for all purposes. The distribution is by gravity from the reservoir. The watershed is all forest growth up to the top of Mt. Kearsarge. The main line of pipe is of cast iron, and the service pipes hard wrought iron. The pipe from the reservoir to Main street consists of 150 feet of ten-inch pipe, 1,625 feet of eight-inch pipe, and 13,569 feet of six-inch pipe, making a total of 15,344 feet. The aggregate distribution service amounts to 28,538 feet of pipe. T. C. Shirley, President; D. Lowell Lamson, Secretary and Treasurer. A. R. Jenness, Superintendent.

The samples were all taken from a tap in the house of the Superintendent.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness	Chlorine	Free ammonia.	Organic ammonia.
82	February 14 ..	1.4	.8	.79	.2	.000	.003
102	April 23	1.6	.8	.79	.2	.000	.006
127	June 5.......	1.4	1.	.95	.3	.000	.005
175	August 13....	2.6	2.2	1.27	.2	.000	.002
230	October 15....	2.2	1.2	.95	.2	.005	.006
274	December 16 .	1.2	1.0	.48	.1	.000	.003
Averages........		1.7	1.1	.87	.2	.0009	.0041

Gardiner Water Company.

The supply is taken from the Cobbosseecontee stream about one mile above the city. This stream is the outlet of the lake by the same name and also of various smaller ponds to the south of it. The water is pumped into a reservoir from which it is distributed by gravity. The two samples were received through the courtesy of Dr. Giddings of Gardiner.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
108	April 29......	3.0	1.4	1.69	.3	.001	.017
288	December 27..	3.2	1.8	1.69	.2	.001	.012
Averages........		3.1	1.6	1.69	.25	.0012	.015

Hallowell Water Co.

The supply is taken from springs. one of which is the Mace spring on Winthrop hill, and the other the Gow spring at the head of Chestnut street. When a large supply is needed water is pumped from a large reservoir on the city farm, a mile and a half away. The reservoir at each spring is about eighty feet square, while the one at the town farm is eighty feet wide by three hun-

dred feet long. The water from the springs is delivered by gravity, but in very dry times the water is pumped from the reservoir on the farm. Cast iron is used for the main pipe and galvanized iron mostly for the distribution service. Joseph F. Bodwell, President; Orlando Currier, under whose supervision the works were built, is Secretary and Superintendent.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
76	February 3...	5.0	2.4	3.25	.6	.000	.005
100	April 20.....	3.6	1.2	2.21	.5	.000	.004
129	June 5.......	5.2	2.0	3.25	.8	.000	.004
199	September 11..	7.4	2.6	4.29	.7	.000	.014
260	November 7...	5.2	2.4	3.51	.4	.000	.000
284	December 24..	4.4	3.6	3.25	.6	.001	.006
Averages.......		5.1	2.3	3.29	.6	.0003	.0058

Houlton Water Co.

The water is taken above the village from the north branch of the Meduxnekeag river which is fed by numerous brooks and springs chiefly located in letter B, Range 2, (Hammond Plantation). The watershed is about ten miles square, mostly covered with a forest growth, while the remainder is sparsely inhabited by a farming population. Distribution is effected by pumping to a stand-pipe as required, alternated with distribution from the stand-pipe by gravity flow. The distance from the pumping station to the stand-pipe is about one mile, and the center of distribution is about midway between. Gravel filtration or straining is effected at the collecting crib which is located a little above the pumping station. The material for the main pipe is cast iron and the distribution system consists of patent enamel wrought iron pipe. The water was put on in October, 1885. Crafts and Fogg, Boston, were the engineers. Walter Mansur, President; James Frank Holland, Secretary, Treasurer and Superintendent.

The samples were taken from the collecting-crib.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
121	May 23........	5.8	3.0	3.25	.2	.001	.018
197	September 11..	8.2	4.8	4.57	.2	.001	.019
Averages........		7.0	3.9	3.91	.2	.0015	.0185

Lewiston Water Works.

The source of supply is the Androscoggin river, about two miles from the point of distribution. The water is pumped into a reservoir of about 84,050 square feet in superficial area. The water is filtered through sea gravel. Cast iron is used for the main pipes and hard pipe for the distribution service. The water was put on Dec. 25, 1888. M. M. Tidd was the engineer. E. S. Davis, President; Walter A. Goss, Clerk.

The samples for analysis were taken from a tap.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
93	March 5......	4.0	2.4	1.95	.2	.000	.017
98	April 19......	3.6	2.4	1.43	.2	.000	.015
182	August 25....	4.2	2.2	1.69	.4	.000	.014
243	October 24....	4.0	3.8	1.27	.1	.000	.019
280	December 19..	3.6	1.6	1.95	.1	.001	.013
Averages		3.8	2.4	1.65	.2	.0005	.0158

Norway Water Co.

This company's supply is taken from the foot or lower part of Pennesseewassee Pond, a short distance above the village. The pond is about four miles in length. The water is pumped into a reservoir from which it is distributed by gravity. The main pipe is

of cast iron and the distribution system consists of galvanized iron pipe. Water was first supplied September, 1886. E. H. Gowing was the designing engineer. W. H. Whitcomb, President; W. W. Whitmarsh, Superintendent.

The samples were all taken from a tap except No. 154, which was taken from the pond.

No. of analysis	Date of collection.	Total solids.	Loss on Ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
109	April 28......	3.2	1.6	1.95	.2	.001	.012
154	July 14.......	3.8	3.4	1.95	.3	.001	.012
194	September 6..	3.4	1.8	1.95	.3	.000	.015
266	November 15..	4.0	1.8	1.95	.2	.001	.009
290	December 31..	2.8	1.0	1.95	.2	.001	.011
Averages........		3.4	1.9	1.95	.24	.001	.0121

Old Orchard Water Company.

The source of the supply is a spring called the "Old Indian," situated on high land two-thirds of a mile from any dwelling. The source of supply is three and one-third miles from the points of distribution. The reservoir at the spring has a capacity of 500,000 gallons. The spring is surrounded by forest growth, principally hardwood. For domestic use, the system of distribution is by gravity; for fire protection, direct pumping. The main pipe is of cast iron and the service pipes galvanized iron. The supply began February 1st, 1888.

This company is controlled by the Consolidated Water Supply Company of Boston. The works were done under D. R. Clark as engineer. E. C. Phipps, President; J. W. Brown, Treasurer; J. W. Duff, Old Orchard, Superintendent.

The first sample was taken from the reservoir; the remaining four samples were taken from a tap at the residence of the Superintendent.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
94	March 6.	2.2	2.0	1 95	.6	.000	.003
117	May 9........	2.8	1.4	1.27	.6	.001	.005
200	September 13..	3.6	1.4	1.27	.6	.000	.000
262	November 8...	2.8	1.4	1.69	.4	.000	.000
283	December 24..	3.0	1.6	1.27	.4	.001	.003
Averages........		2.8	1.5	1.49	.52	.0006	.0024

PORTLAND WATER COMPANY.

The water is taken from Sebago Lake, seventeen miles from the city. This lake and its tributary lakes have an area of about one hundred square miles. The whole watershed comprises about three hundred square miles, sparsely populated. The distribution is effected by gravity. The water is strained but not filtered. The main pipes consist of wrought iron and cement. The distribution system is mostly of iron pipe. The supply began in 1869. D. W. Clark, President; E. R. Payson, Secretary; George P. Wescott, Superintendent.

The samples were all taken from a tap in the water company's office.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
77	February 6 ...	2.4	1.4	1.69	.4	.000	.007
111	May 2..... ..	2.6	1.2	1.56	.4	.000	.010
144	June 19......	2.2	1.6	1.27	.4	.000	.008
187	August 31....	3.0	1.6	1.27	.4	.000	.009
246	October 29....	2.0	1.8	1.95	.2	.000	.009
273	December 15.	2.6	1.4	1.27	.1	.000	.009
Averages........		2.4	1.5	1.50	.31	.000	.0087

Presque Isle Water Co.

The water is taken from Kennedy Brook about one mile from the principal points of distribution, the intake being from an artificial pond of three and three-fourths acres in extent. That part of the watershed which lies immediately around the reservoir consists of three thousand acres originally hard wood growth about one-half of which is now cleared and cultivated. Back of the farm land lies a large swamp the water from which percolates through a ridge of gravel supplying the springs that feed the brook. The distribution is effected by gravity. The main pipe is of cast iron, while the service pipes are of enameled wrought iron. The water supply began Oct. 1, 1887. The works were built by Arthur W. Forbes as engineer; G. H. Freeman, President and Superintendent, Chas. P. Allen, Secretary.

The samples for analysis were all taken from the same tap.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition	Hardness.	Chlorine	Free ammonia.	Organic ammonia.
83	February 13 ..	17.4	1.4	14.84	.2	.000	.000
113	May 6	10.2	2.8	8.86	.3	.001	.011
174	August 9.....	16.4	7.0	13.31	.2	.002	.011
233	October 15....	13.6	4.	11.35	.1	.003	.008
291	December 30..	12.0	3.8	10.75	.2	.000	.005
Averages		13.9	3.8	11.82	.2	.0012	.007

Camden and Rockland Water Company.

This supply comes seven and one-half miles, from Mirror Lake, known on the maps as Oyster River Lake. This pond contains about 131 acres, and is fed entirely by springs having no brook as an inlet. The watershed consists of 650 acres with very steep slopes. The east side of the lake is bounded by a rocky mountain full of springs all running into the pond. There are no inhabitants living on the watershed and no parts under cultivation. The land is mostly covered with a forest growth of hard and soft wood. The distribution is by gravity. The supply is ample for all purposes.

The main lines consist of iron pipe, and the service pipes are of cast iron and galvanized iron. The works went into operation in November, 1885. Percy M. Blake, Hyde Park, Mass., was the designing engineer. A. F. Crockett, President; W. S. White, Secretary and Treasurer: J. W. Crocker, General Superintendent. This company supplies also the towns of Camden, Rockport, and Thomaston, in addition to the city of Rockland and will extend its pipes to the new summer resort on Rockland Bay Point the coming season of 1889.

The samples were all taken from a tap in the office of the company.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
97	April 13......	2.2	2.0	.48	.6	.000	.009
141	June 14......	1.8	1.2	.48	.6	.001	.008
181	August 24....	3.2	1.8	1.27	.6	.000	.007
258	November 5...	2.2	.8	1.27	.44	.001	.005
276	December 17..	2.0	1.4	1.27	.36	.000	.006
Averages..........		2.2	1.4	.95	.52	.0006	.0074

SANFORD WATER CO.

The sources of supply are springs, one of which is on a hill three-fourths of a mile from the village and the other in a valley one-eighth mile distant. One of these springs (spring-fed ponds?) is about one-half acre in area, the other about ten acres. One of the sources is surrounded by heavy forest growths, the other is situated in a cultivated field. The springs are bricked up and cemented and covered with wooden buildings, so that it is impossible for surface or other water to get in without filtering through the soil. The water is brought from one of the springs by gravity and the other by pumping. Wrought iron pipes were used for the main line, and wrought iron and galvanized iron, principally the latter, are used for the distribution system. The water supply began Sept. 17, 1887. The works were put in under the supervision of E. M.

Goodall. E. M. Goodall, President and Superintendent; E. E. Hussey, Clerk.

The samples were all taken from a tap.

No. of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
156	July 16.......	4.2	1.6	2.99	.4	.006	.000
244	Oct. 25.......	4.8	1.2	2.60	.4	.001	.000
278	Dec. 18.......	2.8	1.0	2.60	.2	.001	.001
Averages..........		3.9	1.2	2.73	.33	.0028	.0005

Skowhegan Water Company.

The source of supply is a brook fed by springs that break out from a ravine in a high, sandy plain. The intake is about one mile from the centre of the village, and is formed by a dam on a brook. The water is pumped into a stand-pipe, from which it is distributed by gravity. Iron pipes are used for both the main and distribution system. The works are not completed yet. R. B. Shepherd, President. The one sample of water was taken from the collecting crib.

No. of analysis, 257; date of collection, Nov. 6; total solids, 4.8; loss on ignition, 1.8; hardness, 1.27; chlorine, .36; free ammonia, .002; organic ammonia, .009.

Springvale Aqueduct Company.

The source of supply is Littlefield's pond, about one mile from the village. This pond has an area of twenty-five or thirty acres. A part of the surrounding territory is farm lands, the remainder is wooded pasture. Distribution is effected by gravity. A filter of sand and charcoal is in use. The material for the main line consists of log and iron pipes, and for the distribution system iron pipes are used. The works have been in use since 1886, and were put in under the supervision of Moses A. Dennett. S. D. Tibbets, President; John A. Dennett, Secretary, Treasurer and Superintendent.

The samples were all taken from a tap.

No of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness	Chlorine.	Free ammonia.	Organic ammonia.
67	Dec. 31.......	2.4	2.2	1.95	.4	.006	.017
180	Aug. 14......	2.6	2.2	.95	.4	.000	.014
242	Oct. 18.......	2.8	2.6	.48	.2	.000	.020
287	Dec. 29.......	1.6	1.2	.48	.2	.002	.016
Averages..........		2.3	2.0	.96	.3	.0022	.017

WATERVILLE WATER CO.

The water is taken from Messalonskee river, the outlet of the pond by the same name. The intake is only one-eighth of a mile from the nearer points of distribution. The system of distribution employed is direct pumping and the use of a reservoir. Tar coated pipes are used for both the main and distribution systems, cast iron being used for the former and cast and wrought iron for the latter. The supply began Jan. 1, 1888. The work was done under the supervision of Lewis and Maxcy. The works also supply the village of Fairfield. G. A. Phillips, President; Weston Lewis, Treasurer; J. S. Maxcy, Secretary.

The samples were taken from different points as follows: May 15, from the pump well; Aug. 14, from a tap in the office of the Company; Oct. 30, from a tap in the pump house, and Dec. 28, from the tap in the office.

No of analysis.	Date of collection.	Total solids.	Loss on ignition.	Hardness.	Chlorine.	Free ammonia.	Organic ammonia.
118	May 15.......	3.4	2.2	1.43	.4	.001	.022
179	Aug. 14......	3.6	1.8	1.95	.3	.000	.012
247	Oct. 30.......	2.8	2.4	1.95	.2	.000	.014
286	Dec. 28.......	3.4	2.2	1.69	.16	.001	.013
Averages..........		3.3	2.1	1.75	.26	.0007	.0155

NOTES ON THE FOREGOING ANALYSES OF SAMPLES FROM PUBLIC WATER SUPPLIES.

AUBURN—*Color*, very slight, or none; *odor*, none; *nitrites*, none, excepting slight trace in 90 and 112; *nitrates*, none, excepting very slight trace in 90, 143 and 186.

AUGUSTA—*Color*, light brown; *odor*, considerable in 75, in other samples slight or absent; *nitrites*, none; *nitrates*, generally slight trace, in 119 heavy trace. No. 107 turbid, with much blackening on ignition.

AUGUSTA, DEVINE WATER CO—*Color* and *odor*, none; *nitrites*, none; *nitrates*, trace; phenomena of ignition, none.

BANGOR—*Color*, light brown; *nitrites*, a slight trace in 84 only; *nitrates*, slight trace in 84 and 275; residue blackens considerably on ignition.

BAR HARBOR—*Color*, very slight; *nitrites*, slight trace in 79, much in 161; *nitrates*, slight trace in 79 and 161 residue blackens on ignition.

BATH—*Color*, slight in 259; *odor*, slight in 65, 145 and 259; *nitrites*, slight trace in 105, 145 and 191; *nitrates*, slight trace in all excepting 269.

BELFAST—*Color*, light brown; *nitrites*, trace in 148; *nitrates*, slight trace in all excepting 241; residue blackens considerably on ignition.

BIDDEFORD AND SACO—*Color*, light brown; *odor*, considerable in 81 and 128; *nitrites*, slight trace in 99 and 173; *nitrates*, slight trace in all, excepting 272; residue blackens on ignition, and in 99, much. Nos. 99 and 128 slightly turbid, with some sediment.

BRUNSWICK—*Color*, the first three samples (from old source) light brown, the last three, slight; *odor*, considerable in 78; *nitrites*, considerable in 78, and trace in 103; none in last three samples (from new source); *nitrates*, heavy trace in 103 and 185, and trace in 78 and 140. Residue blackens considerably in first three samples.

CALAIS—*Color*, light brown, and much in 106 and 282; *nitrites*, none; *nitrates*, slight trace in 92 and 106. Residue blackens on ignition, and in 106, much. When 106 was taken, the river was bringing down much sawdust and other refuse from the saw mills above.

FRYEBURG—*Color*, none or slight; *nitrites*, slight trace in 82 and 127; *nitrates*, slight trace in 102 and 230. Some sediment in 127.

GARDINER—*Color*, light brown; *nitrites*, none; *nitrates*, slight trace; residue blackens on ignition. Some turbidity in 208.

HALLOWELL—*Color*, none or slight; *nitrites*, very slight trace in 76, 100 and 129; *nitrates*, a trace in 129 and 199 and a heavy trace in 76, 100 and 260.

HOULTON—*Color*, light brown; *nitrites* none; *nitrates*, slight trace. Residue blackens considerably on ignition.

LEWISTON—*Color*, light brown; *nitrites*, slight trace in 98; *nitrates*, slight trace in all; residue blackens considerably on ignition.

NORWAY—*Color*, light brown; *nitrites*, none; *nitrates*, very slight trace in all. Residue blackens slightly on ignition. Sample 154 was slightly turbid.

OLD ORCHARD—*Color*, none; *nitrites*, very slight trace in 94 and 117; *nitrates*, slight trace in 117 and 200.

PORTLAND—*Color*, slight; *nitrites*, none; *nitrates*, very slight trace in 111. Residue blackens some on ignition.

PRESQUE ISLE—*Color*, light brown; *nitrites*, trace in 83, *nitrates*, trace in 174 and heavy trace in 291.

ROCKLAND—*Color*, none; *nitrites*, none; *nitrates*, very slight trace in 141 and 181.

SANFORD—*Color*, none; *nitrites*, a trace in 244 and 278, and much in 156; *nitrates*, trace in 156 and 244.

SKOWHEGAN—*Color*, slight; *nitrites*, none; *nitrates*, very slight trace; residue darkens on ignition.

SPRINGVALE—*Color*, light brown; *nitrites*, slight trace in all except 287; *nitrates*, a trace in 67 and 180; residue blackens considerably on ignition. No. 180 contained considerable sediment with some infusoria and fresh water algae, and 242 contained some sediment which, upon testing, was found to contain iron.

WATERVILLE—*Color*, light brown, and in 118 was considerable; *nitrites*, slight trace in 179; *nitrates*, slight trace in 179 and 247. Residue blackens some on ignition. No. 118 contained some sediment.

As an aid in estimating the possible influence of rain fall upon any given sample of water, the precipitation for each month and day of 1888 is given in inches and hundredths. Snow, after melting, is measured as rain-fall. The records were made by Mr. Henry Richards, at Gardiner.

Jan. 2	1.56	Feb. 5	.90	March 7	.15	April 2	.60
7	.15	6	.70	13	.60	6	.35
8	.08	8	.63	14	.40	12	.45
10	.10	9	.05	22	2.03	13	.28
13	.39	11	.31	23	.12	15	.22
15	.31	15	.20	27	.56	22	.30
18	.37	21	1.90	31	.25	29	.07
24	.17	26	1.21				
27	1.90						
Total	5.13	Total	5.90	Total	5.09	Total	2.27

May 1	.07	June 1	.10	July 7	.07	Aug. 4	.17
2	.22	6	.35	12	.81	7	.47
5	.12	14	.15	13	.06	9	.13
9	.22	15	.31	15	.15	14	1.20
10	.18	18	.01	21	.15	17	.38
13	1.16	22	.20	22	.15	22	.86
15	.09	23	.15	24	.06	25	.16
29	.42	25	1.02	27	.10	26	.87
		26	.05	28	.06	27	.09
		30	.25	30	.17		
				31	.42		
Total	2.48	Total	3.57	Total	2.20	Total	4.33

Sept. 1	1.15	Oct. 2	.52	Nov. 3	.27	Dec. 6	.02
2	.05	7	2.72	11	1.58	10	.06
9	.84	13	.59	16	.51	12	1.29
12	.53	18	.32	17	.33	18	1.99
18	1.78	20	.62	19	.70	19	.02
23	1.14	24	.84	22	.07	27	.82
26	1.60	29	1.10	28	2.47		
28	.03			30	.05		
Total	7.12	Total	6.71	Total	5.98	Total	4.20

MISCELLANEOUS ANALYSES—Expressed in Parts per 100,000.

Number of Analysis.	Origin of Sample.	Date of Collection.	Total Solids.	Loss on Ignition.	Hardness.	Chlorine.	Free Ammonia.	Organic Ammonia.	Nitrites.	Nitrates.
		1888								
66	Well, Springvale	Jan. 1	22.0	8.0	11.80	5.4	1.308	.039	Trace.	Some.
68	Well, North Yarmouth	" 11	1.8	1.4	1.27	.6	.000	.000	Slight trace.	None.
69	Janies' Pond, Hallowell	" 13	5.8	4.0	1.95	.6	.005	.059	None.	Trace.
70	Well, North Yarmouth	" 11	19.2	4.8	5.29	8.4	.000	.004	Slight trace.	Slight trace.
71	Well, Fairfield	" 12	17.2	5.2	11.05	1.7	.003	.017	Trace.	Much.
72	Well, Augusta	" 19	16.8	7.8	9.57	1.6	.001	.000	Trace.	Much.
73	Well, Winthrop	" 24	12.0	4.4	4.57	3.8	.001	.012	Trace.	Trace.
74	Cistern, Augusta	" 30	8.0	6.0	5.29	.6	.025	.012	Very much.	Slight trace.
80	Well, Hanover	Feb. 10	4.0	1.6	1.95	.5	.000	.002	Slight trace.	Trace.
86	Ash Tree Fountain, Insane Hospital	" 17	11.8	4.2	7.43	.8	.000	.000	Slight trace.	Trace.
91	Well, Waterville	" 27	19.4	11.0	8.57	2.8	.002	.001	Much.	Much.
95	Well, Auburn	Mar. 26	14.6	5.4	8.86	1.6	.000	.005	Trace.	Much.
96	Spring, Insane Hospital	Apr. 11	5.4	2.0	3.25	.4	.000	.005	Much.	Slight trace.
101	Well, Augusta	" 23	33.0	13.4	22.86	1.8	.000	.004	Trace.	Much.
114	Well, Madison	May 8	11.8	5.0	3.90	2.6	.002	.007	Trace.	Heavy trace.
115	Well, Madison	" 8	13.6	6.0	8.86	1.4	.018	.003	Very much.	Much.
116	Well, Biddeford	......	15.6	4.2	8.86	1.0	.008	.030	None.	Slight trace.
120	Well, Machiasport	May 13	3.0	2.4	.95	1.8	.009	.016	Slight trace.	Heavy trace.
122	Well, West Kennebunk	" 25	3.6	1.2	1.56	.6	.000	.004	None.	Heavy trace.
123	Well, Lisbon	June 1	10.2	4.0	6.71	1.2	.000	.008	None.	Trace.
124	Well, Augusta	" 4	42.2	20.4	22.86	2.8	.000	.004	Slight trace.	Very much.
125	Well, Fryeburg	" 3	7.6	3.0	2.86	1.0	.000	.002	Heavy trace.	Much.
126	Spring, Fryeburg	" 3	13.4	5.6	3.90	2.4	.000	.007	Slight trace.	Much.
130	Carrabasset river, North Anson	" 6	2.8	1.8	1.27	.2	.000	.012	None.	Slight trace.

131	Kennebec river, State House tap	"	7	8.4	2.4	1.56	.8	.000	.013	None.	Slight trace.
132	Kennebec river, Augusta, opposite State House	"	7	3.4	2.4	1.69	.3	.000	.014	None.	Slight trace.
133	Moosehead lake	"	7	3.0	2.4	1.56	.2	.000	.013	None.	Slight trace.
134	Kennebec river, The Forks	"	6	3.8	2.6	1.27	.4	.000	.017	None.	Slight trace.
135	Dead river, The Forks	"	6	4.2	2.0	1.43	.3	.003	.022	Slight trace.	Slight trace.
136	Well, Presque Isle	"	7	77.4	13.4	39.20	2.6	.018	.151	Trace.	Very much.
137	Cistern, Augusta	"	12	7.0	3.8	3.51	.1	.016	.026	Much.	Slight trace.
139	Well, Kennebunk	"	25	20.4	11.6	7.71	1.4	.003	.013	....	Much.
146	Spring, Castine	"	25	44.4	18.4	19.60	4.2	.000	.013	Slight trace.	Trace.
147	Well, Castine	"	26	65.2	27.0	20.40	12.6	.004	.012	None.	Much.
150	Well, Melville street, Augusta	July	10	79.2	42.8	21.19	9.4	.189	.009	Slight trace.	Much.
151	Well, Augusta	"	12	19.6	6.8	8.86	3.2	.003	.018	Trace.	Trace.
152	Well, Lisbon	"	12	49.0	25.0	20.40	6.0	.002	.003	Much.	Much.
153	Well, Mason	"	13	9.0	5.6	2.99	1.2	.008	.014	Much.	Much.
155	Well, Sanford	"	15	5.6	3.6	3.25	.6	.004	.005	Heavy trace.	Trace.
157	Well, Blanchard	"	16	3.8	1.2	2.60	.2	.000	.000	None.	Slight trace.
158	Well, Saccarappa	"	17	9.8	2.8	5.29	1.4	.000	.003	Trace.	Heavy trace.
159	Well, Portland	"	18	61.6	22.6	18.81	9.0	.096	.015	Very much.	Very much.
160	Well, Portland	"	18	83.0	38.6	33.80	11.2	.000	.005	Heavy trace.	Very much.
162	Spring, Madison	"	23	12.8	4.0	10.00	.4	.001	.001	Trace.	Trace.
163	Well, Springfield	"	25	46.0	17.8	28.12	2.2	.008	.017	Much.	Heavy trace.
164	Spring, Limington	"	30	2.8	1 0	.79	.4	.003	.014	None.	Slight trace.
165	Well, Castine	"	30	49.2	19.8	16.75	7.8	.002	.003	Much.	Much.
166	Well, Castine	"	30	17.8	3.8	13.01	1.0	.059	.008	Very much.	Slight trace.
167	Well, Sprague's Mills	"	31	21.8	7.8	14.84	.7	.002	.001	Slight trace.	Much.
168	Well, Greenville	Aug.	1	19.8	4.2	6.71	1.8	.000	.010	Trace.	Much.
169	Well, Stockton	"	2	39.6	12.8	6.71	5.0	.000	.009	Slight trace.	Much.
170	Spring, Locke's Mills	"	1	3.4	2.0	1.95	.4	.007	.009	None.	Slight trace.
171	Well, Locke's Mills	"	3	29.6	5.8	12.56	3.4	.001	.011	Trace.	Heavy trace.
172	Village pump, Locke's Mills	"	3	12.8	6.4	2.34	2.2	.000	.010	Trace.	Trace.
176	Well, Yarmouthville	"	14	16.8	6.8	7.43	2.0	.270	......	Very much.	Much.
177	G. T. R. R. reservoir, Gilead	"	14	4.2	2.2	1.69	.1	.003	.015	None.	Heavy trace.
178	Well, Lisbon	"	15	15.4	7.0	6.00	1.4	.000	.000	Trace.	Slight trace.
183	Well, Jefferson	"	27	59.6	24.4	18.81	8.2	.001	.019	Trace.	Very much.
188	Well, Brooks	"	31	8.6	6.2	2.60	1.6	.001	.005	None.	Heavy trace.
189	Well, South Norridgewock	"	31	17.4	4.8	7.43	1.4	.017	.015	Slight trace.	Trace.
190	Reservoir, Waldoboro	....		8.0	4.2	2.60	.8	.041	.027	Much.	Trace.
192	Well, Bethel	Sept.	3	4.2	2.8	1.95	1.0	.000	.005	Trace	Trace.
193	Well, Bethel	"	3	6.8	2.6	1.95	1.6	.022	.017	Slight trace.	Heavy trace.

MISCELLANEOUS ANALYSES—Expressed in Parts per 100,000—Concluded.

Number of Analysis.	Origin of Sample.	Date of Collection.	Total Solids.	Loss on Ignition.	Hardness.	Chlorine.	Free Ammonia.	Organic Ammonia.	Nitrites.	Nitrates.
195	Artesian well, Peak's Island	Sept. 8	19.8	12.2	6.00	2.8	.000	.002	Trace.	Heavy trace.
196	Well, Rockland	" 10	38.2	14.0	10.30	3.8	.000	.012	None.	Much.
201	Well, Hope	" 11	4.2	2.0	1.69	.6	.001	.001	....	None.
202	Reservoir, Waldoboro	" 18	12.0	3.2	6.71	1.0	.001	.007	None.	Trace.
203	Well, China	" 17	60.0	29.0	21.19	6.0	.001	.003	Heavy trace.	Much.
204	Well, Waterville	" 22	5.2	2.0	5.29	.6	.000	.003	None.	None.
205	Spring, West Baldwin	" 23	7.6	2.0	2.99	.4	.001	.006	Heavy trace.	Slight trace.
206	Well, West Baldwin	" 24	3.2	1.6	1.95	.4	.000	.010	None.	None.
207	Well, Augusta	" 25	46.6	13.4	13.31	4.4	.002	.012	None.	Much.
208	Well, Swanville	" 23	7.0	3.6	5.29	.5	.001	.001	None.	None.
209	Well, Portland	" 23	13.7	2.4	3.90	.8	.001	.000	None.	Slight trace.
210	Well, Portland	" 25	62.2	13.2	24.52	17.5	.000	.000	None.	Much.
211	Well, East Jefferson	" 25	24.0	10.0	12.56	1.7	.003	.018	None.	Much.
212	Spring, East Jefferson	" 25	18.8	3.8	6.43	19.6	.027	.009	None.	Heavy trace.
213	Well, Houlton	" 24	45.4	18.4	31.26	2.8	.012	.012	Very much.	Heavy trace.
214	Well, Hebron	" 27	16.4	5.8	6.29	2.2	.001	.007	Slight trace.	Much.
215	Well, Hebron	" 26	28.8	14.0	10.75	3.0	.001	.017	Trace.	Much.
216	Well, Milo	" 29	7.6	5.0	2.60	.8	.000	.006	None.	Trace.
217	Spring Brook, Machias	" 25	3.6	2.4	.79	.6	.001	.009	Trace.	Slight trace.
218	Well, Oxford	Oct. 1	13.2	6.2	4.29	2.2	.003	.003	Trace.	Trace.
219	Well, Oxford	" 1	8.8	4.0	2.60	.8	.000	.001	None.	Trace.
220	Well, Washburn	" 1	8.8	5.2	4.57	.8	.005	.009	Trace.	Trace.
221	Well, Washburn	" 1	21.0	14.0	7.43	1.0	.000	.008	Heavy trace.	Much.
222	Well, Washburn	" 2	6.6	3.0	2.86	.8	.001	.008	Trace.	Trace.

223	Well, Washburn	"	2	7.8	4.6	4.57	.5	.001	.009	None.	Trace.
224	Well, Caribou	"	4	18.6	7.2	16.43	.0	.050	.010	Heavy trace.	Trace.
225	Spring, Locke's Mills	"	6	7.2	4.0	7.43	.1	.003	.001	None.	None.
226	Well, Bethel	"	8	5.6	4.0	2.60	.6	.000	.004	None.	Trace.
227	Well, Bethel	"	7	3.4	1.0	3.25	.1	.000	.010	None.	Slight trace.
229	Well, Brewer	"	11	77.4	28.8	17.22	8.4	000	.016	Slight trace.	Much.
231	Spring, Yarmouth	"	16	18.0	8.4	6.43	2.4	.002	.019	Slight trace.	Heavy trace.
232	Well, Yarmouth	"	16	25.4	13.0	9.57	3.2	.000	.006	Slight trace	Heavy trace.
234	Well, Winthrop	"	19	13.0	2.8	3.90	.2	.000	.009	None.	Slight trace.
235	Well, Winthrop	"	19	45.4	17.0	17.22	11.8	.002	.008	None.	Slight trace.
236	Well, Brooks	"	19	9.8	3.8	6.00	2.2	.000	.003	None.	Slight trace.
237	Well, Brooks	"	19	19.6	7.2	7.86	4.0	.001	.012	None.	Heavy trace.
238	Well, Yarmouthville	"	19	6.4	1.6	1.27	.4	.000	.018	None.	Slight trace.
239	Well, Castine	"	18	19.8	6.4	6.43	2.6	.001	.011	None.	Heavy trace.
240	Well, Castine	"	17	40.6	17.2	14.84	6.4	.001	.008	Heavy trace.	Heavy trace.
249	Well, Saccarappa	"	28	3.4	1.2	1.69	.6	.000	.007	None.	Slight trace.
250	Well, Saccarappa	"	28	4.0	2.2	1.95	.6	.000	.005	None.	Trace.
251	Well, Princeton	"	26	62.4	20.8	39.20	10.4	.065	.044	None.	None.
252	Well, Princeton	"	26	63.8	27.2	36.04	11.4	.033	.064	Much.	Much.
253	Well, Brooks	"	29	16.0	6.0	6.71	2.0	.001	.002	Slight trace.	Heavy trace.
254	Well, Brooks	"	30	16.2	5.6	8.57	3.4	.001	.004	Slight trace.	Much.
255	Spring, Kennebunk	"	31	5.4	2.4	2.60	1.0	.000	.000	None.	None.
256	Well, Kennebunk	"	31	23.0	4.8	6.00	5.0	.000	.014	None.	Heavy trace.
263	Cistern, Island Falls	Nov.	6	7.2	4.4	4.57	.4	.002	.030	None.	Slight trace.
264	Well, Augusta	"	12	23.8	6.4	13.31	2.6	.000	.009	Much.	Heavy trace.
265	Well, Hallowell	"	12	45.0	13.0	16.90	3.4	.002	.009	Heavy trace.	Slight trace.
268	Well, Bowdoinham	Dec.	3	4.2	1.4	2.99	.5	.001	.012	None.	None.
270	Well, Berwick	"	6	8.4	1.4	3.12	.8	.000	.002	None.	Slight trace.
271	Well, Berwick	"	6	13.8	6.2	4.03	2.1	.000	.003	None.	Heavy trace.

NOTES ON SOME OF THE FOREGOING ANALYSES.

No. 66. This sample was remarkable for the large amount of organic matter which it contains, and illustrates well the fact that a water may be clear and colorless and nevertheless be very badly polluted. The sample was without color and had but slight odor. Upon ignition of the residue there was much blackening, and a pungent odor was developed. It will be seen that the quantity of free and organic ammonia was enormous, particularly the former. The well from which this sample was taken was reported to be an ancient one, situated eighteen feet from the barnyard, pig-pen and stable, and twenty-five feet from the privy, and easily receives the surface water and drainage from an unusually filthy barn, cellar and yard. A hen-house door also opens within four feet of the well and the ground is covered with hen manure. The soil is sandy and rocky. Eighteen or twenty cows are watered from this well, and the milk from them is sold in the village. Diphtheria had prevailed to a considerable extent in the village and the milk had been used in most of the families where the disease prevailed. The family used water from another well. They have sore throat and diphtheria nearly every year.

No. 68. This sample upon the whole is the best water that has been examined in the laboratory. It is remarkable for the small amount of total solids, for its softness and for the absence of organic matter. Though taken from a well it is a spring water of the finest quality. The sample was taken from a well about 450 feet distant from the buildings. The well was dug through coarse gravel and is twelve feet deep and the bottom is formed by a ledge on which the water comes in. The water is always abundant in the well, its depths varying from one foot to six feet according to the dryness or wetness of the season.

No. 69. The sample was taken from Janie's Pond, Hallowell.

No. 70. Chemically, this sample has too much chlorine and this result taken in connection with the fact that the history of the well shows possibilities of pollution, the water cannot be considered free from suspicion.

No. 74. This sample was taken from a cistern and the analysis is a fair representation of the character of cistern waters as they are usually collected ahd stored. It is not a desirable drinking water.

No. 86. This sample was taken from what is called the Ash Tree Fountain in the field above the Insane Hospital and not far from Military street. This consists of a cistern or reservoir receiving spring water from the ground. It is about twelve feet in diameter, fifteen feet in depth, and the water was about ten feet deep when the sample was taken. It was built about thirty years ago, but the water has not been used for severel years. This fountain is directly above the new laundry and engine house and as water could be introduced into this building more economically than from the other spring which supplies the hospital with drinking water it was proposed to introduce the water from the Ash Tree Fountain, if, upon analysis, it should prove to be good. The results of the single analysis were very favorable indeed and the water from this source was therefore put into this new building.

No. 95. This sample from a well in the city of Auburn gives much better results chemically than are usually found with waters from city wells. The depth of the well is ten feet; it had three and a half feet of water in it at the time the sample was taken, and the depth of the water in the well varies but little from this the year round. The flow of the water into the well is rapid and the good results are probably partly due to that fact.

No. 96. From the spring which supplies the Insane Hospital with drinking water. It is situated in the woods and distant from any source of pollution. The examination shows it to be a spring water of good quality. Compared with analysis No. 86 it will be seen that it is a softer water than that of the Ash Tree Fountain.

No. 114. An analysis of this water was desired on account of the suspicion that its use might have been the cause of fever and diarrhœa. The sample contained an abundance of thin opalescent crystals of silicate of soda, and this might account for the disagreement of the water with those who were not accustomed to its use, causing diarrhœa as the report states. The well is too near the sink drain and privy, forty-five feet respectively. The water is of doubtful quality.

No. 115. The well from which this sample came was situated seventy feet from the sink drain, eighty-two feet from the privy, and a little over one hundred feet from the stable, and in the lowest part of the lot where the land slopes two ways to it from buildings. The drainage is therefore towards the well, but the well was said to be well banked up with clay soil so as to exclude the surface water.

The chemical results show that the water is polluted. One case of typhoid fever last fall and one at the time the sample was taken.

No. 120. The examination of this water was desired on account of the presence of typhoid fever in the family who used it. The present occupants moved into the house eight months ago, and at the time the sample was taken, May 13th, three of the children were sick with typhoid fever. The water is polluted.

No. 122. The location of this well shows an utter disregard of all the rules of good judgment in choosing a spot for a well. The well is situated close in an angle between the main part of the house and the ell and only a few feet from the barn, eight feet from the discharge of the sink drain and ten feet from the privy. The family using the water had been troubled with diphtheritic sore throats, skin affections, etc. The results of the chemical analysis which are so much more favorable than has ever before been found in a well so badly situated raised a suspicion of an error as regards the source of the water. At any rate it may be said of a well thus situated that nobody possessed of ordinary judgment and good sense would wish to use the water or have it used in his family no matter what might be the result of a single chemical analysis.

No. 125. This sample contained also a small quantity of lead, derived undoubtedly from 142 feet of lead pipe through which the water is pumped to the house with a force pump. The use of lead pipe to draw water for drinking purposes from wells and cisterns is not to be recommended. There is more danger from the use of lead pipe for such purposes than there is where the water flows continually through the pipe.

Nos. 130, 131, 132, 133, 134, and 135. Arrangements were made in the spring for having samples of water taken from our three principal rivers, the Penobscot, the Kennebec, and the Androscoggin, at various points, but with the other work which was on hand in the office it was found impracticable to carry the study of the waters from these sources along with the examinations of the public water supplies. The carrying out of this investigation is reserved for the future. It was designed to have these samples taken at the same time. No. 130 was taken from the Carrabasset river about one hundred rods above the falls at the village of No. Anson. No. 131 from the Kennebec river, was drawn from the tap at the State House, June 7th. No. 132 was taken on the same day from the

Kennebec river, opposite the State House or a little higher up and below the city sewers. No. 133 was taken the same date from Moosehead Lake, half way between Deer Island and Greenville. No. 134 was collected June 6th, from the Kennebec river just above the Forks. No. 135 was taken from Dead river just above the Forks. No deductions can be made from the results of the analyses particularly from the two samples collected at the Forks for the water was very high at the time and the streams were crowded with logs.

No. 136. This well, sixteen feet in depth, was dug two feet through sandy loam to the ledge and then drilled fourteen feet. The stable and barnyard are situated to the north about ninety feet and on higher ground, but a personal inspection showed that the surface wash would probably not find its way directly into the well. The water is of a reddish brown color, has considerable odor when heated, and upon ignition of the residue considerable temporary blackening occurred. The water is badly polluted, undoubtedly by the drainage from the barnyard which probably sinks downward through the rather thin covering of soil to the ledge and then flows along its surface to the well, or possibly finds a direct passage through some fissure in the ledge. The limestone ledges of Aroostook are very permeable for water and are often filled with seams and crevices. Typhoid fever occurred in the house in which the water from this well is used in 1884 and again in 1888.

No. 139. The depth of this well is fourteen feet and it is distant from thirty-five to thirty-eight feet from the sink drainage, the privy and the stable. These places all undoubtedly come within the circle of ground which the well drains. The results would show it to be a suspicious water.

Nos. 146 and 147. No. 146 does not give results which make the water entirely above suspicion, and 147 would indicate a polluted water.

No. 150. It is from a well in the more thickly built part of the city. It is badly polluted, though the water is odorless and colorless and the owner had supposed it to be a good water. Considerable ill health has occurred in the family.

No. 151. This is another well in the older and more thickly settled part of the city. The water is polluted as is usual with shallow city wells. The well is seventeen feet deep, the lower half

of which is sunk in a bed of soft blue clay from which the water comes.

No. 152. This sample came from a well twenty feet deep, distance six feet from the ell of the house, fifteen feet from the sink drain, forty feet from the privy, and seventy-five feet from the stable. The soil is sandy with a gravelly sub-soil. The depth of water in the well is two feet, never varying much from that. The following is a part of the report on the sample:

"In the case of your well, the sink drain and privy are both nearer than is safe, but the well is quite deep and the moderate depth of water has a deep origin. The finding of the analysis is in accordance with these circumstances. Apparently, the soakage from the sources of pollution, in its filtration through a considerable depth of soil is oxidized and changed so that instead of yielding much free and organic ammonia, we get it in the form of much nitrites and nitrates accompanied with much chlorine. These constituents in themselves are not harmful, but they indicate that a slight sewage pollution reaches the well and suggest the possibility that the pollution may sometimes come from the same sources in more dangerous form. It must be said that it is a suspicious water and great care should be taken with the management of the sink drain and the privy to avoid further pollution of the ground."

No. 153. The report stated that this water is bad and not fit for drinking purposes. As the well is within fifteen feet of the barnyard and thirty feet of the stable and pig pen, it is likely that the fouling of the water comes from these sources.

No. 158. This is a sample of the pure water which may be drawn from the ground by going deeply enough, even in places where there is considerable surface pollution. The well from which this water came is fifty feet in depth. It was dug fourteen feet to soft blue clay, then bored with an eight inch auger into the clay twenty-six feet from which point an iron pipe was driven ten or eleven feet farther to a stratum of sand a few inches in thickness which rested upon a ledge. Other sections of iron pipe were coupled on the driven pipe and the hole filled with sand within twelve feet of the surface, from which point to the surface clay was tamped around the pipe. Water thus taken is practically beyond the reach of pollution.

No. 159. A shallow well, fourteen feet deep with sink drains and privies within distances from twenty to forty feet. Very badly luted.

No. 160. Another well from the city, but deeper, thirty-three feet deep, and with sources of pollution a little more removed, privy fifty feet, stable one hundred feet. It illustrates well, the effects of soil filtration,—low ammonia figures and much chlorine, nitrites and nitrates. It is nevertheless, not a desirable drinking water, on account of the possibilities of infection and extreme hardness and large total solids.

No. 162. A sample of pure water from a spring not subjected to any chances of pollution.

No. 169. "From the results of the analysis we can not say that the water is a first-class well water; neither from the results of the analysis would it be justifiable to condemn it. The most that can be said is, that it is a water which is slightly suspicious. The manure shed and barnyard are hardly at a safe distance. A small quantity of lead was found in the water, which shows that the lead pipe is dissolved to a slight extent. The water should always be pumped out of the pipe and thrown away before a pailful is taken for use."

No. 170. From a spring which is said to have the surface wash from cultivated land. The free and organic ammonia are in larger quantities than are found in the best of spring waters.

No. 176. A very bad water. The sample came from a well twenty-one feet deep, distant only three feet from a tenement house, thirty-five or forty feet from the sink drain and two privies, and twelve feet from stagnant slop hole, where dirty water is thrown out. The surface of the ground is nearly level and the soil and sub-soil are sandy. A child who drank the water constantly was sick and the attending physicians with sufficient reason it may be said, attributed the sickness to poisoning with the water and suggested that an analysis be made.

The following exhibit of the record from the laboratory "field book" showing how the free ammonia came off in twenty-eight consecutive Nessler glasses may be interesting to analysts. Carbonate of sodium was added after the twenty-third.

1st,	.240	6th,	.030	11th,	.030
2nd,	.120	7th,	.035	12th,	.030
3rd,	.060	8th,	.040	13th,	.035
4th,	.040	9th,	.045	14th,	.035
5th,	.035	10th,	.030	15th,	.035

16th, .035	20th, .035	25th, .045
17th, .035	21st, .035	26th, .045
18th, .035	22nd, .035	27th, .045
19th, .035	23rd, .040	28th, .045
	24th, .045	

The water was slightly turbid, the odor was very bad, and there was marked blackening upon ignition of the residue. It was found impracticable as a matter of curiosity to exhaust the free ammonia. To the non-professional reader we would say that in estimating the free ammonia it is rarely necessary to take off more than two, three or four Nessler glasses of distillate.

Nos. 190 and 202. These are samples of water from a reservoir in Waldoboro which it was proposed to utilize as a public water supply. The first sample was collected and sent without instructions from the board in regard to the necessary precautions to be observed. There was therefore a suspicion that the vessel containing the sample had not been made chemically clean. Supposing the proper precautions were taken the results of analysis No. 190 would be decidedly against the fitness of the water for a public drinking supply, while No. 202 gave much more favorable results.

No. 203. Well forty feet deep; distance from sink drain, stable and barnyard thirty or thirty-five feet; from privy, eighteen feet. The well is dug through a clayey loam and the lower half of the well is in a ledge. The following is from the report on the sample.

"The total solids, upon evaporating the water, are exceedingly high, and it is a very hard water, though a water as hard as this may usually be drank without bad effects by those who are accustomed to it. As far as the two ammonias are concerned the water is all right, but there are indications of the pollution of the well by drainage which has undergone a change in passing through the ground, from the form of ammonia to that of nitrites and nitrates. These constituents do not indicate so much danger as we should expect when the pollution shows itself in the form of ammonia. The chlorine is also largely in excess, and this would have to be taken as another indication of pollution. The surroundings of the well are not favorable, and to get rid of the possibilities of bad results, as far as possible, I should advise carrying the sink drainage to a safe distance through a tight drain and keeping the privy vault as dry as possible, which you seem to have been trying to do."

No. 204. A sample of good well water.

No. 208. A well thirty-six feet deep through a clayey loam. There are no probable sources of pollution excepting the sink drain which runs within ten feet of the well. The following is from the report made to the owner of the well.

"Chemically there is nothing wrong whatever with the water, but no matter what the chemical analysis shows, I should consider the water exceedingly dangerous with the present proximity of the leaky sink spout, especially since you have typhoid fever in the house. Under such conditions the infection of the ground around the well with some of the poisonous matter from the patient which has been discharged through the wash water or otherwise, would be quite likely to reach the well, or at least there would be great danger of it. The infectious germs of the disease might in this way reach the water and poison it dangerously, although the quantity of the organic matter which would thus get into the water might altogether defy the chemist's art to discover.

"I should by all means advise a different method of disposal of the sink water. It should be carried in a tight iron pipe until it has passed the well a considerable distance. With the arrangements which you have now, the ground about the well will be gradually polluted more and more, and every year the line of pollution will work deeper and nearer the well until at last it is very likely that a chemical examination would tell a different story about the water. I would advise the non-use of the water for a considerable time unless it is boiled thoroughly. This is a very soft water and with such there is more danger in using a lead pipe than with hard waters. Whether boiled or not the first pailful should always be thrown away before a pailful is pumped for use, to lessen the danger of lead poisoning."

No. 209. This well, 297 feet deep, in the city of Portland supplies a factory with drinking water and illustrates that a supply of good and pure drinking water may often be procured in cities where the surface is polluted, by boring to a considerable depth. The boring extended through gravel, marl, clay, and finally into rock in which the water stands, or is collected. A considerable quantity of iron was found in the water.

No. 210. A well in Portland fifty-five feet deep, at the corner of two streets, and used by many. The sample is characterized by high figures for the total solids and chlorine, with much nitric acid and a minimum quantity of ammonia.

No. 213. A well on the county lot near the jail and court house in Houlton. The school-house is situated near the well and the water had been used by the children, among whom there had been considerable sickness, principally of diphtheria and sore throat. The water is polluted, and was reported as not good or safe to be used as a drinking water.

No. 217. This sample was from a proposed source for a public water supply. It was collected Sept. 25th. It is a very soft water. The report said: "As far as I can judge from this single analysis the character of this water would not be unsuitable as a public water supply, but before deciding this question other analyses should be made and the surroundings of the proposed source should be taken into consideration."

Nos. 220, 221, 222, 223. These analyses show the results of the examination of the wells in Washburn in connection with the outbreak of typhoid fever in that place. Very heavy and continuous rains had fallen between the time of the infection of the locality and the taking of the samples, and this fact may have had something to do in making the results better than were anticipated.

No. 225. A sample of spring water, which is brought about 300 feet through galvanized iron pipe. The following is from the report to the owner of the water supply:

"Upon boiling the water it becomes turbid or milky. Upon testing to learn the cause of this turbidity I find it is due to zinc which is, of course, derived from the galvanized iron pipe through which the water flows. Otherwise than the contamination with zinc the water is good for drinking purposes. As regards the harmfulness of zinc contaminated waters there is a difference of medical opinion, some claiming that it is not injurious and some that it is. I should prefer to be on the safe side and not use the water for drinking and domestic purposes so long as it becomes turbid upon boiling."

No. 229. From a well nineteen feet deep, and in clayey soil. The cellar drain passes near the well and the sink drain, privy and stable are distant from thirty-six to fifty feet. The sample was collected Aug. 13th, after the heavy rains. Typhoid fever was prevalent among the users of the water. Report was made to the attending physician as follows:

"Looking down the column you will see that the total solids are represented by a high figure, that the chlorine is in excess, and that there are two or three times as much organic ammonia as there

ought to be. The large quantity of nitrates, designated as nitric acid, is also confirmatory of the conclusion which we shall draw that the water is badly polluted for a well water, and rather badly polluted for even a city well water. The well undoubtedly receives soakage from the privy and sink drainage, and at all times must be considered dangerous; and when typhoid fever is prevailing in the house, and for quite a long while afterwards (nobody knows just how long in a given case, of course,) it must be considered very dangerous."

Nos. 234 and 235. No. 234 is from a well situated in a field ninety or one hundred rods from the buildings to which the water is brought through an iron pipe. No. 235 is distant only two rods from the house and at distances of forty to seventy-five feet from the sink-drain, privy, stable and pig pen. Report was made as follows:

"The two sheets enclosed will give you the results of the analyses of the two samples of water which you sent. You will notice that there is considerable difference in the two waters. The chemical examination shows that there is nothing wrong about No. 234 as a drinking water. On the other hand, sample No. 235 is not good and any chemist would instantly condemn it for drinking purposes. You will notice that No. 235 has its total solids represented by a much higher figure than the other and that its chlorine is more than fifty times as much. No. 236 is also a much harder water than the other, but this is more of an economic question than one of healthfulness."

Nos. 236 and 237. Sample No. 236 is from a well forty-two feet deep and with sources of pollution not nearer than from sixty to one hundred and twenty feet. No. 237 is from a well only fifteen feet in depth, within ten feet of the highway and on ground slightly lower than the road. The samples were taken Oct. 19th, and after the heavy rains. The following report was made to the secretary of the local board:

"I enclose two separate sheets which will give you the results of the analyses of the two samples of water which you sent. On account of the recent heavy rains it was not a good time to take samples of water for analysis. Under such circumstances wells which are so situated that they may receive the surface wash of the surrounding ground may show results worse than they would under ordinary circumstances. In most cases, however, wells do not show results so bad as when the water is low.

"In sample 236 the chemical examination shows nothing decidedly bad about the water. No. 237 shows, in the excess of chlorine, organic ammonia, and nitrates, evidences of pollution although the history of the well as you give it in the blank shows nothing to account for it, excepting the possibility of surface drainage from the highway and other surrounding ground.

Nos. 249 and 250. No. 249 was from a well twenty feet deep distant fifty to seventy-five feet from sources of pollution; and No. 250 was from a well twenty-five feet deep with sources of pollution from seventy-five to one hundred feet distant. The sample was taken Oct. 21st. The report stated that: "The chemical examination shows nothing whatever against these waters for drinking purposes. It was not a good time, however to take samples from wells when these were taken, on account of the recent heavy rains, but it is doubtful whether we should ever find anything very bad in them."

Nos. 251 and 252. No. 251 was taken from a well twenty-five feet deep, eight feet of which was dug through the earth and the remaining depth into a ledge. The sink drain, privy and stable are only thirty feet distant, and a pig pen and slaughter house are respectively forty and fifty feet away. The well is said to be protected with a drain, and to be cemented with Portland cement to keep out the surface water, protection which the results of the analysis show does not protect. No. 252 is understood to be on the same lot and is distant fifty feet from the sink drain, twenty feet from the privy, and five feet from the stable. The following was a part of the report on the sample:

"The samples of water which you sent me, both proved to be very bad, in fact, any chemist would immediately say that they are wholly unfit for use. . . . . The bottles were not marked, or rather the blanks which you returned with them were not, so that I cannot tell you which is which, but as their character is so nearly alike, it is a matter of no importance."

No. 263. The sample was taken from a cistern in a cellar beneath the house in which three cases of typhoid fever occurred. The chemical results are not so unfavorable as are frequently found with cistern waters. The following is the report which was made on the sample:

"Otherwise than the large quantity of organic ammonia, the chemical analysis shows nothing wrong about the sample. The excess

of organic ammonia indicates the presence of an excess of organic matter in the water, and whenever the cistern is emptied and cleaned out there will undoubtedly enough of this be found. A cistern built as you say this is could undoubtedly be polluted with the germs of typhoid fever if they were in matter which had been thrown out around or too near the cistern, so that the drainage could reach its vicinity. Cements are quite porous and cisterns are sometimes polluted in this way, but the blank which you filled gives no indications whether this might be possible."

ADDITIONS TO THE LIBRARY.

During the year 1888 the following books, journals and pamphlets were added to the library of the Board by exchange and by purchase.

Books.

McVail. Vaccination Vindicated. London. 1887.

Billings. Swine Plague. Lincoln, Neb. 1888.

Hueppe. Methods of Bacteriological Investigation. Trans. by Biggs. New York. 1886.

Wood. Fresh Water Algæ. Washington. 1872.

Kent. A Manual of the Infusoria. London. 1882.

De Bary. Comparative Morphology and Biology of the Fungi, Mycetozoa, and Bacteria. Oxford. 1887.

Wolle. Fresh Water Algæ of the United States. Bethlehem, Pa. 1887.

———. Desmids of the United States. Bethlehem, Pa. 1884.

Pritchard. Infusorial Animalcules. London. 1852.

Schmidt. Atlas der Diatomaceenkunde. 1875.

Wells. Water Power of Maine. Augusta. 1869.

Cassino. International Scientists' Directory. Boston. 1888.

Herrick. Crustacea of Minnesota. Minneapolis. 1884.

Stokes. Preliminary Contribution toward a History of the Fresh Water Infusoria of the United States. (In Jr. of the Trenton Nat. Hist. Soc.) 1888.

Rosenthal. Gesundheitspflege. Erlangen. 1887.

Koch and Gaffky. Erforschung der Cholera in Jahre 1883 nach Egypten und Indien entsandten Kommission. Berlin. 1887.

Arbeiten aus dem Kaiserlichen Gesundheitsamte. Vierter Band. Berlin. 1888.

Pettenkofer. Zum gegenwartigen Stand der Cholerafrage. Munich and Leipzig. 1887.

Fleischer. Lehrbuch der Inneren Medizin. Wiesbaden. 1888.

Sajous. Annual of the Universal Medical Sciences. 5 vols. Philadelphia, 1888.

Index Catalogue of the Library of the Surgeon General's Office. Vol. IX.

Transactions of the Ninth International Medical Congress. 5 vols. Washington. 1887.

Reports and Papers of the American Public Health Association. Vol. XIII.

Transactions of the Medical Association of the State of Missouri.

Transactions of the New York Academy of Medicine. Vol. V. 1886.

Transactions of the Rhode Island Medical Society. Vol. III, Part 5. 1887.

Transactions of the New Hampshire Medical Society.

Transactions of the Medical Society of Pennsylvania. Vol. IX. 1887.

Transactions of the Maine Medical Association for 1888.

Reports.

Seventh Annual Report of the State Board of Health of New Hampshire. 1888.

First Annual Report of the State Board of Health of Vermont.

Second Annual Report of the State Board of Health of Vermont.

Nineteenth Annual Report of the State Board of Health of Massachusetts.

Tenth Annual Report of the State Board of Health of Rhode Island.

Tenth Annual Report of the State Board of Health of Connecticut.

Eighth Annual Report of the State Board of Health of New York.

Eleventh Annual Report of the State Board of Health of New Jersey.

Seventh Biennial Report of the State Board of Health of Maryland.

Eighth Annual Report of the State Board of Health of South Carolina.

Fifteenth Annual Report of the State Board of Health of Michigan.

Second Annual Report of the State Board of Health of Ohio.

Sixth Annual Report of the State Board of Health of Indiana.

Fourth Biennial Report of the State Board of Health of Iowa.

Second Annual Report of the State Board of Health of Pennsylvania.

Eleventh Annual Report of the State Board of Health of Wisconsin.

Third Annual Report of the State Board of Health of Kansas.

Sixth Annual Report of the Provincial Board of Health of Ontario.

First Annual Report of the Provincial Board of Health of New Brunswick.

Seventh Annual Registration Report of New Hampshire.
Forty-Sixth Registration Report of Massachusetts.
Thirtieth Registration Report of Connecticut.
Thirty-Fourth Registration Report of Rhode Island.
Annual Report of the Supervising Surgeon General, M. H. S. for 1888.
Report of the Commissioner of Education. 1885 and 1886.
Annual Report of the Board of Health, Fall River, Mass., 1887.
Annual Report of the Board of Health, Taunton, Mass., 1887.
Third Annual Report of the Board of Health, Hartford, Conn., 1888.
Annual Report of the Board of Health, Portland, Me., 1888.
Annual Report of the Board of Health, Augusta, Me., 1887-8.
Report of the Local Board of Health, Newburgh, N. Y., 1886.
Third Annual Report of the Board of Health, Newark, N. J., 1887.
Third Annual Report of the Board of Health, Patterson, N. J., 1886.
Tenth Annual Report of the Board of Health, Augusta, Ga., 1887.
Report of the Department of Health of Chicago. 1887.
Eleventh Annual Report of the Health Com. of St. Louis, Mo., 1888.
Report of the Board of Health, Montreal. 1887.

Sanitary and other Journals for 1888.

The Index Medicus. Detroit and Boston.
The Sanitarian. New York.
The Sanitary News. Chicago.
The Engineering and Building Record. New York.
The Annals of Hygiene. Philadelphia.
The Sanitary Record. London.
Building. New York.
The Medical Record. New York.
The Boston Medical and Surgical Journal.
The Archives of Pediatrics. Philadelphia.
The Brooklyn Medical Journal. Brooklyn, N. Y.
The Pittsburgh Medical Review.
The New York Medical Times.
The Lancet. London.
Science. New York.
The Satellite. Philadelphia.

The American Monthly Microscopical Journal. Washington.
The Microscope. Detroit.
The Journal of Comparative Medicine and Surgery. Philadelphia.
The Medical Standard. Chicago.
Occidental Medical Times. Sacramento.
The Medical World. Philadelphia.
The Microscopical Bulletin. Philadelphia.
Public Health in Minnesota.
Monthly Bulletin of the Iowa State Board of Health.
Bulletin of the North Carolina Board of Health.
Bulletin of the State Board of Health of Tennessee.
Monthly Bulletin of the Connecticut State Board of Health.
Monthly Bulletin of the State Board of Health of Rhode Island.
Monthly Sanitary Record, State Board of Health of Ohio.
Revue D'Hygiene. Paris.
Annales D'Hygiene Publique. Paris.
Giornale della Reale Societa Italiana D'Igiene. Milano.
Gesundheits Ingeniur. Munich.
Archiv für Hygiene. Munich and Leipzig.
Deutsche Vierteljahrsschrift für offentliche Gesundheitspflege. Braunschweig.
Zeitschrift für Hygiene. Leipzig.
Centralblatt für allgemeine Gesundheitspflege. Bonn.
Deutsche Medicinische Wochenschrift. Berlin.
Schweizerische Blätter für Gesundheitspflege. Zurich.
Zeitschrift für Schulgesundheitspflege. Hamburg.

PAMPHLETS.

Jones. Refuse Destructors.
Holmes. Incineration of the Dead.
Herrick. The Real and the Ideal in Hygiene.
Prudden. On Bacteria in Ice. 1887.
Homan. 'Observations on Police Service and Physique in St. Louis.
Freire. Yellow Fever.
Pinkham. The Ventilation of School-Rooms heated by stoves.
Lee. Should not the National Government Defend our Ports against the National Enemy Contagious Disease?
Baker. Malaria; and the Causation of Periodic Fever.
———. Causation of Pneumonia.

Gerhard. Drainage of a House.

Kellogg. Dangers in Gasoline.

Furnell. Cholera and Water in India.

Foods and Food Adulterations. Dept. Agric. 1887.

Constitution, By-Laws, etc., of the State Board of Health of Pennsylvania.

Tucker. Report on the Analysis of Drugs.

Provincial Board of Health of Ontario. Abstracts of Acts respecting Vaccination and Inoculation.

An. Rpt. of the Inspector of Milk, Vinegar, and Petroleum. Holyoke, Mass. 1886.

State Board of Health of N. Y. School Hygiene. 1888.

Connecticut State Board of Health. Rules and Regulations.

Report on the Drinking Waters of Maryland.

Laws of Delaware for the Preservation of Public Health.

Regulations Concerning the Analysis of Foods and Drugs in the District of Columbia. 1888.

State Board of Health of Wisconsin. Prevention of Sickness.

Report of Committee on Sanitation of Lynn, Mass. 1886.

Trans. Mass. Medico-Legal Society. Vol. I, No. 4. 1881.

The Sanitary Code of the Borough of Ashbury Park, N. J. 1887.

Regulations of the State Board of Health of Vermont.

The First Quarterly Report of the Michigan State Laboratory of Hygiene.

Report of the Proceedings of the Woodstock Sanitary Convention Ontario. 1887.

Proceedings of the National Conference of State Boards of Health, Sept. 7th, 1887.

Proceedings of the Illinois State Board of Health. January, June and October, 1888.

Proceedings of the Michigan State Board of Health, Apr. 10, 1888.

Proceedings at a Sanitary Convention at Manistee, Mich. 1888.

Manual of Health Laws of Ohio. 1887.

EXPENSES OF THE BOARD.

The amount and character of the expenditures of the Board for the year 1888 were as follows:

Engraving and drawing............	$24 54
Books and sanitary journals.	306 64
Paper and stationary........... ...	92 36
Postage..........	134 00
Printing and binding...	566 76
Secretary's salary..........	2000 00
Expenses of members...	124 35
Express and telegraph.............	195 57
Travelling expenses of secretary. ...	238 89
Clerical help......	517 50
Miscellaneous	46 47
Chemical and microscopical supplies..	120 36

Total. $4367 44

EXTRACTS FROM THE REPORTS

OF THE

LOCAL BOARDS OF HEALTH.

ABBOTT.

Members of the board: A. P. Race, Secretary; Edwin Faunce, Chairman; W. W. Delano.

One nuisance has been removed. We have had fifteen cases of diphtheria with one death and one case of typhoid fever.

ADDISON.

Members of the board: F. A. Chandler, M. D., Secretary; H. M. Ingersoll, Chairman; N. W. Curtis.

Two nuisances were reported to the board and were removed. Five cases of typhoid fever occurred in the town, but no two cases occurred in the same family, or in the same neighborhood. These cases were isolated and precautions were taken to disinfect all discharges from the patient, and to disinfect the clothing.

ALBION.

Members of the board: C. W. Abbott, M. D., Secretary; Otis Meader, Esq., Chairman; R. L. Baker.

We had one case of diphtheria and three cases of typhoid fever, all of which ended in recovery. Jaundice appeared in an epidemic form; there were over thirty cases.

ALEXANDER.

Members of the board: George B. Berry, Secretary; Jones A. Bohannon, Chairman; C. M. Huff.

No cases of infectious diseases, excepting a few of measles and chicken-pox. The diarrhœal diseases were quite prevalent in the summer, but only one death occurred.

ALFRED.

Members of the board: Frank W. Smith, M. D., Secretary; Sam'l Came, Chairman; J. F. Day, M. D.

We have had three cases of diphtheria, but no deaths from this cause. All in all it has been a very healthful season.

ALNA.

Members of the board: A. M. Card, M. D., Secretary; Benj. Donnell, Chairman; A. B. Erskine.

Nine cases of nuisance were reported and were promptly cared for. Fevers were less prevalent than usual and no cases of the infectious diseases have occurred.

ALTON.

Members of the board: A. H. Twitchell, M. D., Secretary; Amasa Hatch, Chairman; A. J. Hatch.

One nuisance was reported which gave no trouble in its removal. No cases of the infectious diseases have occurred. For the purpose of diffusing a knowledge of correct sanitary principles, it might perhaps be well to have a tract or catechism which should be required to be taught in our common schools, so that every scholar would be compelled to learn certain sanitary facts, methods, etc.

AMHERST.

Members of the board: Geo. A. Lord, M. D., Secretary; N. P. Sumner, Chairman; F. W. Foster.

Measles and whooping cough were unusually prevalent, but there have been fewer cases of all other diseases in town than for many years.

ANDOVER.

Members of the board: E. E. Bedell, Secretary; W. W. Barnes, M. D., Chairman; C. A. Cushman.

For the year 1888 we have had no cases of the infectious diseases, excepting mumps.

ANSON.

Members of the board: Ben Moore, Secretary; Byron Hutchins; E. M. Wing, M. D.

Typhoid fever has been quite prevalent, but in scattered cases. Some minor nuisances have been remedied.

ARGYLE.

Members of the board: J. N. Tracy, Secretary; S. J. Buzzell, Chairman; S. L. Freese.

We have had no cases of infectious diseases excepting chicken-pox.

ARROWSIC.

Members of the board: Jason McFadden, Secretary; Wm. H. Spinney, Chairman; Thos. J. Rairden.

It has been a very healthful year with only two deaths. One from pneumonia, and one from consumption.

ASHLAND.

Members of the board: Chas. L. Dunn, Secretary; J. H. Carter, Chairman; E. A. Duren, M. D., Health Officer.

We have had seven cases of typhoid fever, no other infectious diseases.

ATHENS.

Members of the board: M. L. Marr, M. D., Secretary; J. S. Tobey, M. D., Chairman; L. N. Ellingwood, M. D.

There have been three cases of typhoid fever with one death. Each case was in a different family and in each case the discharges were disinfected and buried. The disease was not in any instance communicated to any other member of the family or to any other person. No cases of small-pox, diphtheria, or scarlet fever have occurred. The sanitary conditions throughout the town are generally in a healthful state.

ATKINSON.

Members of the board: George W. Harvey, Secretary; E. W. Trask, Chairman; W. S. Leason.

The town has been free from contagious disease for the past year.

AUBURN.

Members of the board: J. W. Beede, M. D., Secretary; Henry Lowell, Chairman; Daniel Lara.

The public water supply has been extended to about forty families more by carrying an eight-inch pipe across the little Androscoggin river.

The board of health has tried to get the city to furnish a garbage cart for the removal of the refuse of both vegetable and animal substances from grocery stores and boarding houses, but without effect.

Twenty-two nuisances have been reported, thirteen of which have been abated by removal or by connecting with the street sewers. Four have been partially abated. In addition to these fourteen others were discovered by the board and abated by compelling the owners to enter the street sewer. Of the nuisances unabated there were six tenement houses so situated as to make any drainage that could be suggested very expensive and unsatisfactory, and others were owned by non-residents from whom promises were obtained, but nothing more. In some cases the houses were old and must soon give place to new ones.

There have been reported twenty-three cases of diphtheria, fourteen of scarlet fever, and eight of typhoid fever.

One case of scarlet fever was communicated to a man of middle life by his shop-mate who worked beside him, and whose children had the disease, and the probabilities point to contagion by fomites in another case where the child was so mildly and doubtfully affected as to lead the parents to use less than the required means to destroy infection. Seven of the diphtheria cases were due either to direct or indirect infection.

AVON.

Members of the board: Jonas Badger, Secretary; Joel Wilbur, Chairman; N. E. Gould.

We had one fatal case of diphtheria and two cases of typhoid fever. The houses were placarded.

BAILEYVILLE.

Members of the board: John D. Lawler, Secretary and Health Officer; Jas. G. Smith, Chairman; G. W. Libby.

We have had no cases of the infectious diseases, excepting one of typhoid fever.

Baldwin.

Members of the board: I. S. Chase, Secretary; J. M. Sanborn, Chairman; Lorenzo Norton, M. D.

One case of typhoid fever ended in recovery. In our sanitary arrangements an improvement would be made by locating the wells farther from the sink spout and barnyard.

Bangor.

Members of the board: John Goldthwait, Secretary; Dr. D. A. Robinson, Chairman; A. R. Taney, M. D.

Five thousand feet of sewer pipe were laid down during the year. Only a very few cases of nuisances have been reported, and all have been removed, but we have done a large amount of work the past year, inspecting premises, having filth removed, and drains connected with the sewers, and have successfully carried out this and other work pertaining to the board.

We have had 11 cases of diphtheria with 2 deaths, 6 of scarlet fever, and 51 of typhoid fever with 11 deaths. When cases of the infectious diseases have occurred we have isolated the families, placarded the houses, notified the teachers in the school, and looked after the case until the period of contagion had passed. In addition we have had the premises properly cleansed and fumigated.

Bath.

Members of the board: E. M. Fuller, M. D., Secretary; R. D. Bibber, M. D.

The number of deaths which occurred in Bath in 1888 was 155. The following are some of the causes of deaths with the number which occurred from each: Consumption, 23; heart disease, 13; paralysis, 13; old age, 12; pneumonia, 11; cholera infantum, 7; accident, 5; Bright's disease, 4; dropsy, 3; bronchitis, 3; apoplexy, 2; typhoid fever, 2; membranous croup, 2; whooping cough, 1.

Six nuisances were reported to the board, all of which were removed. Two deaths occurred from diphtheria, and four from typhoid fever. It has been a very healthful year and free from epidemics.

Belfast.

Members of the board: L. T. Shales, Secretary; H. P. Thompson, Chairman; A. C. Ellingwood, M. D.

The city has employed a civil engineer who has laid out an extensive system of sewerage. Four sewers have already been built through the principal streets, and it is contemplated to build a thorough system of sewerage the coming season. Ten nuisances were reported all of which were removed. The citizens generally seem to be disposed to aid the board in this work, as they understand it is for their benefit. We have had one case of typhoid fever and two of scarlet fever, all of which recovered. When cases of the infectious diseases have occurred the houses in which they were, have been visited, circulars pertaining to the particular disease have been given to the inmates, and children from these houses have been excluded from the schools until all danger has passed. None of the schools have had any of the contagious diseases enter them. Several of the school buildings the past year have been greatly improved by putting in city water, removing old privy buildings, and substituting the water closet, putting in sewers and steam heating throughout the buildings.

Belmont.

Members of the board: Miles Pease, Secretary; N. B. Allenwood, Chairman; D. A. Greer.

No cases of the infectious diseases have occurred.

Benedicta.

Members of the board: John Rush, Secretary; J. J. Curran, Chairman; John Sullivan.

With the exception of a few cases of mumps, whooping-cough, and measles, we have had no infectious diseases.

Bethel.

Members of the board: J. A. Twaddle, M. D., Secretary; E. B. Goddard, Chairman; A. B. Godwin.

There is prospect that the coming year the village of Bethel Hill will be supplied with water taken from Chapman Brook four miles from here. This will make our village one of the most healthful in New England.

Two nuisances were reported to the board and they were abated to our satisfaction. Five cases of scarlet fever have occurred and two of typhoid fever. Infected families have been isolated, houses placarded, and instructions in regard to disinfection and otherwise have been given.

Bingham.

Members of the board: T. F. Houghton, Secretary; J. D. Merrill, Chairman; A. A. Piper, M. D., Health Officer.

No cases of diphtheria, scarlet fever, or typhoid fever have occurred. We would recommend for the village better drainage and in some instances a better water supply.

Blaine.

Members of the board: John M. Ramsey, Chairman; A. O. Nutter, Secretary; Jonathan Hersom.

We have had one case of typhoid fever, but otherwise, with the exception of a few cases of rash, we have been very free from diseases. We made improvements last year in some unhealthful places, and have no such localities to report this year. One case of glanders was taken care of by the State Veterinarian.

Blanchard.

Members of the board: E. P. Blanchard, Secretary; Chas. B. Packard, Chairman; Willis H. Knapp.

No cases of the infectious diseases have occurred.

Bluehill.

Members of the board: R. P. Grindle, M. D., Secretary; A. C. Osgood, Chairman; R. G. Lord.

During the last four months of the year typhoid fever was unusually prevalent, twelve cases occurring with one death. The cause of some of these cases appeared to be imperfect drainage of the premises; other cases were caused by contagion. The fever in one case seemed to have been contracted while attending the funeral of a friend who died of that disease. One unhealthy locality in East Bluehill has been improved by means of drainage with good effect.

Boothbay.

Members of the board: Alden Blossom, M. D., Secretary; N. S. Baker, Chairman; J. R. McDougal.

Measles were more prevalent than usual and bowel complaints less so. Three cases of scarlet fever occurred, and four cases of typhoid fever with one death. Nuisances have been removed, and infectious places have been quarantined.

BOWDOINHAM.

Members of the board: I. C. Irish, M. D., Secretary; A. H. Cheney, M. D., Chairman; L. D. Small.

Measles and whooping-cough were quite prevalent. Three or four cases of diphtheria, two of scarlet fever, and four of typhoid fever occurred, with one death from the last mentioned disease.

The school house in the village which you examined last spring and the outbuildings which you condemned have been treated as you suggested with great improvement in every respect. Three or four nuisances have been abated by the board. With our people more attention should be paid to the location of wells and their surroundings; the system of building and managing privies should be entirely changed, and the cellars, most of which are wet and frequently contaminated with foul air should be made dry and clean, and well ventilated.

BRADFORD.

Members of the board: L. S. Bickmore, Secretary; H. T. Williams, Chairman; H. D. Worth.

No cases of the infectious diseases have been reported in town.

BRADLEY.

Members of the board: A. E. Perkins, Secretary and Chairman; Fred C. Barton; Eugene Lenfest.

There has been but very little sickness during the year and no cases of the infectious diseases.

BREMEN.

Members of the board: C. B. Palmer, Secretary; Warren Weston, Chairman; Solomon Genthner.

We have had no cases of the infectious diseases.

BREWER.

Members of the board: F. A. Conner, Esq., Secretary; C. P. Thomas, M. D., Chairman; E. A. Stanley.

Last year we reported that our water supply was anything but good. This year we report that it is good. The Holly water has been carried through our streets so that the most of our citizens can get good water for drinking purposes. In regard to drainage, our selectmen have become alive to the necessity for sewers and they have put them through many of the streets, giving drainage to almost all the upper part of the village.

In May all the streets were visited and inspections were made of the premises and advice was given to the occupants in many instances in regard to the sanitary care of the places.

In addition to this, all of the nuisances which were reported have been abated. The good effects of the annual inspection was very apparent. Everybody is glad to be rid of the nuisances which surround him in the easiest possible way.

With the exception of the eight cases of typhoid fever, two of which were fatal, and a short prevalence of German measles or rose rash, we have been very free from the infectious diseases.

There is no town in the county of its size that has done more than Brewer to promote the health of its citizens the past year, and we already feel the effects of it in the improvement of the health of our people.

Bridgewater.

Members of the board: R. H. Perkins, Secretary; Thos. Durgin, Chairman; Chas. Kidder, Esq.

Three cases of nuisances were reported to the board and these were removed. No cases of infectious disease have been reported.

Bridgton.

Members of the board: F. A. Mitchell, M. D., Secretary; Geo. G. Wight, Chairman; John G. Hamblin.

Six nuisances were reported to the board, all of which were removed. Three cases of typhoid fever have occurred, and in connection with them advice was given in regard to disinfection and ventilation.

Brighton.

Members of the board: L. D. Matthews, Secretary; G. C. Davenport, Chairman; L. C. Forbus.

Two nuisances were reported to the board and removed. The past year has been a very healthful one with us.

Brooklin.

Members of the board: E. P. Cole, Secretary; Geo. R. Allen, Chairman; F. S. Herrick, M. D.

No cases of the contagious diseases. We simply organized and made arrangements to have meetings called whenever there should be occasion for the action of the board.

Brooksville.

Members of the board: E. C. Chatto, Esq., Secretary; Jerry Jones, Chairman; S. D. Gray.

No complaints of nuisances have been made, but some advice has been given. All seem willing to do what is necessary. Three cases of scarlet fever and one of typhoid fever have occurred. In the typhoid fever case we had co-operation with the physician in the sanitary precautions, and in the scarlet fever cases the family was isolated, the house placarded, the school near by was closed, disinfection was carried out. The three cases were all in the same family, and no new cases occurred. We are pleased to say the father assisted us all he could.

Brownfield.

Members of the board: H. F. Fitch, M. D., Secretary; S. B. Bean, Chairman; Hiram Gatchell.

We had two cases of small-pox in the spring, the infection of which was derived from the Cumberland Mills outbreak. One of the cases was rapidly fatal. Of four cases of typhoid fever two proved fatal. The cases of typhoid fever were apparently due to bad drinking water.

Brownville.

Members of the board: T. W. Billings, Secretary; T. W. Pratt Chairman; M. S. Berry.

Two nuisances were reported to the board, one of which was a slaughter house and the other a faulty disposal of the sink drainage. Both were taken care of. Five cases of diphtheria occurred, but the patients all recovered.

Brunswick.

Members of the board: M. V. Adams, M. D., Secretary; Franklin Adams, Chairman; F. H. Wilson.

Our water supply is now taken from a spring fed brook and the water seems to be very nice. About the usual number of complaints were made of nuisances and these were all removed as soon as the parties were notified.

During the year we had thirty-eight cases of diphtheria, one of scarlet fever, and twenty of typhoid fever. Five deaths occurred from diphtheria and one from typhoid fever. There was not so marked a prevalence of typhoid fever as during the preceding year. Two of our schools were closed on account of diphtheria among the pupils. We examined the buildings and found the arrangement and care of the privies to be bad in the extreme. We had the privies cleansed and new ones constructed and fumigated the building thoroughly before the schools were re-opened. One case of drowning occurred. We need very much a system of sewerage.

BUCKFIELD.

Members of the board: J. F. DeCoster, M. D., Secretary; J. C. Caldwell, M. D.,; Henry D. Irish.

We have had no cases of the infectious diseases.

BUCKSPORT.

Members of the board: Geo. H. Emerson, M. D., Secretary and Health Officer; G. W. McAllister, Chairman; J. N. Tillock.

A system of drainage and an abundant water supply instead of the use of well water are needed very much. We have had ten cases of diphtheria and twelve of typhoid fever, with two deaths from each disease. In two of the families in which diphtheria occurred, it seemed to originate de novo and general filth. In all of the cases of typhoid fever investigation has revealed a sufficient cause, either in the well water or in the open sink drain. In most of the cases where typhoid fever occurred it seemed as though slops and excreta had practically been poured into the wells. The health officer has made many analyses of drinking water, advised in regard to drainage, shown to many occupants of buildings and sources of danger, tried to educate the people to the importance of good sanitation.

BURLINGTON.

Members of the board: J. W. Bradbury, Secretary; G. N. Page, Chairman; Mellin Strickland.

No cases of the infectious diseases have occurred. We have had but little to do, but have looked after the conveniences of the

school houses and their water supply and have had some improvements made in regard to ventilation, etc.

BURNHAM.

Members of the board: A. W. Fletcher, Secretary; Geo. E. Berry, Chairman; D. Dyer, M. D., Health Officer.

Our water supply comes largely from wells, many of which are favorably located for receiving the drainage from privies, cess-pools, sink spouts, etc. We have had two cases of typhoid fever and in both cases the patients have recovered, and two of fatal cholera infantum. Our school houses are not banked in the fall as they should be, and all except three are very low and with no provision for ventilation, excepting what comes through windows, and the cracks in the walls and floors.

BUXTON.

Members of the board: F. A. Southwick, M. D., Secretary; J. F. Warren, Chairman; J. H. Waterman.

There have been twenty-five cases of diphtheria with four deaths, one of scarlet fever and two of typhoid fever, one of which was fatal. In cases of the infectious diseases the patients have been isolated, houses placarded, the movements of the families have been restricted and upon the termination of the disease, disinfection has been done. Measures have been taken to improve the drainage at the village of West Buxton.

BYRON.

Members of the board: H. H. Richards, Secretary; Geo. F. Thomas, Chairman; John Houghton.

We have had no cases of the infectious diseases.

CALAIS.

Members of the board: D. E. Seymore, M. D., Secretary; C. Ellis, Esq., Chairman; E. H. Vose, M. D.

Our public water supply is good and is coming into more general use. We have had ten cases of diphtheria with two deaths, one case of scarlet fever and six of typhoid fever. Cases of the infectious diseases are isolated and disinfected. The board has been diligent, active and imperative in its requirements in each and every case of infectious disease reported, which has every time, resulted in the suppression of the disease. In a sanitary point of view, our city is our pride and it is second to none in New England.

While we do not claim perfection in all our systems, or deny that future improvements might be made, we have no fear to put in the claim of being rated among the best, in a sanitary condition. We have rigid requirements for the disposition of garbage, and old systems of drainage are giving place to much that is new, but we need still additional sewerage.

CAMDEN.

Members of the board: O. W. Stone, M. D., Secretary; P. B. Cooper, Chairman; Albert Leuce.

Sixteen nuisances have been reported, fourteen of which have been removed. There occurred three cases of diphtheria with one death, and eight cases of typhoid fever with two deaths. No diseases were unusually prevalent, and the bowel complaints in children were less prevalent than usual. We need better sewerage and greater cleanliness about the streets.

CANAAN.

Members of the board: L. W. Shean, M. D., Secretary; David Nason, Chairman; L. G. Lord.

We have had no cases of the infectious diseases. (The Secretary also sends a list of deaths which occurred in the town during the year with their causes. The number of deaths was 18, and the ages of the decedents ranged from 30 to 81 years. Among them, four died of dropsy, three of old age, and one each of tuberculosis, heart disease, pleuritis, cancer of stomach, disease of liver, rheumatism, and softening of brain after typhoid fever. The entire absence of deaths among children is remarkable and perhaps illustrates the difficulty of making a complete collection of deaths or any other of the facts of vital statistics when the collection is deferred to the end of the year. A. G. Y.)

CAPE ELIZABETH.

Members of the board: Thomas B. Haskell, Secretary; S. B. Thombs, M. D., Chairman; J. W. Lowell, M. D.

Eleven cases of nuisance were reported, their causes being water closets, deposits of decayed fish, and of the contents of vaults on farms. We have had two cases of diphtheria and two of scarlet fever with no deaths resulting. In cases of infectious diseases the

families have been visited and cautioned to exercise due care and not to allow neighbors to visit the house. Infected houses have always been placarded and disinfection has been looked after.

Caribou.

Members of the board: J. Cary, M. D., Secretary; Rev. C. E. Young, Chairman; C. B. Roberts, Esq.

Four nuisances were reported to the board, all of which were removed or abated. We have had three cases of diphtheria, with two deaths resulting, and eleven cases of typhoid fever, with one death. Measles were prevalent, and there was a smaller prevalence than usual of diarrhœal diseases. In connection with the infectious diseases we have posted notices and diffused information as to care and prevention of infection. One tenement house seems to be a nidus of typhoid fever.

Greater cleanliness is observable than in the past, and more care is taken generally in the disposition of filth products. There is also a manifest fear, on the part of the public, of contact with contagious diseases, and in consequence, the risk of spreading them is much lessened.

Carmel.

Members of the board: F. A. Simpson, Secretary and Chairman; Henry Kimball; W. A. Swan.

One case of diphtheria and one case of typhoid fever have occurred. The diphtheria case terminated fatally. A case of poisoning came under my observation, which resulted from wearing a muffler made of Germantown yarn, over the mouth. The muffler was bordered with green and clouded, with green ends. The symptoms experienced were nausea and bitterness in the mouth, which caused a good deal of spitting for more than twenty-four hours. After the green was taken off the scarf, and the brown part of it was washed, it turned half a wash tub full of water green. I think the wearing of such colors should be avoided.

Carroll.

Members of the board: N. A. Larrabee, Secretary; C. Lane, Chairman; O. Cushman.

One case of typhoid fever occurred.

Carthage.

Members of the board: S. C. Morse, Secretary; W. W. Goodwin, Chairman; J. S. Swett.

One nuisance was reported to the board, which was removed; and one fatal case of typhoid fever occurred.

Castine.

Members of the board: G. A. Wheeler, M. D., Secretary; Curtis Stevens, Chairman; S. W. Webster.

Seven cases of nuisance occurred, all of which were abated. We have had four cases of diphtheria, two of which terminated fatally, and one case each of scarlet fever and typhoid fever. One of the cases of diphtheria died nine or ten months after apparent recovery. In the spring we had a serious epidemic of measles. In the late fall rheumatic troubles were unusually prevalent, due undoubtedly to the excessive rain fall.

In the early part of the outbreak of measles last spring, there were two cases which the attending physician called measles, and a consulting physician, scarlet fever. When seen by us, eruption had faded, but a decided membrane was found in the throat. One of the children died. The other recovered, and some weeks later was taken ill with genuine measles, which was communicated to two other members of the family. A servant girl in the family was taken ill after the death of the child and before the outbreak of measles, with genuine diphtheria, and communicated the disease in a house which she visited.

Centerville.

Members of the board: J. H. Floyd, Secretary; B. L. Drisko, Chairman; H. W. Foster.

No cases of the infectious diseases have occurred.

Chelsea.

Members of the board: A. N. Douglass, Secretary; A. A. Sampson, Chairman; W. T. Searles, Health Officer.

Three nuisances were reported to the board, all of which were removed. We had two cases of typhoid fever, neither of which was fatal. One case of blood poisoning, which resulted fatally, was taken from dissecting a cow which died.

CHERRYFIELD.

Members of the board: C. J. Milliken, M. D., Secretary; Daniel Willey, Chairman; Samuel Ray.

One nuisance was reported and abated. There has been one case of scarlet fever and five of typhoid fever. One death occurred indirectly from typhoid fever.

CHESTER.

Members of the board: M. H. Haynes, Secretary; A. B. Brown, Chairman and Health Officer; E. L. Keen.

No cases of the infectious diseases have been reported. One death of a child by falling into a pail of hot water.

CHESTERVILLE.

Members of the board: B. F. Makepiece, M. D., Secretary; Edward A. Hall, Chairman; Thos. J. Clough.

Five nuisances were reported, all of which were removed. We have had no cases of the infectious diseases excepting whooping-cough and mumps. Typhoid fever has been in every adjoining town.

CHINA.

Members of the board: G. J. Nelson, M. D., Secretary; F. O. Brainerd, Chairman; E. M. Dowe.

Four nuisances were reported and they were all removed by the parties in fault upon notification by the board. One case of typhoid fever of a mild type. None of the eruptive fevers, except one or two cases of German measles. A complaint was made of one of our village school houses, and an investigation was made of its condition. Upon complaint to the agent the house was in a measure improved, but in my opinion is still dangerous to the health of the attending pupils, both from its location and from the house itself.

COLUMBIA.

Members of the board: John E. Stewart, Secretary; A. H. Leighton, Chairman; A. Y. Tabbutt.

We shall be all ready if there should be any cases of the infectious diseases, but during the past year there has been no work and we hope it will continue so.

COLUMBIA FALLS.

Members of the board: C. C. Bucknam, Esq., Secretary; John F. Pineo, Chairman; Eben F. Allen.

It has been a very healthy season with us, only one case of diphtheria which we investigated, and found the parents exercising due care.

CONCORD.

Members of the board: Benj. F. Atwood, Secretary; C. R. Ellis, Chairman; Amen Savage.

No cases of the infectious diseases. We need better school-houses.

COOPER.

Members of the board: Denison W. Palmeter, Secretary; David Howe, Chairman; Wm. W. Sadler.

Nothing has made work for us, excepting an outbreak of measles in which there were twenty-one cases.

CORINNA.

Members of the board: O. H. Merrill, M. D., Secretary; Edwin Folsom, Chairman; J. C. Pease, Esq.

We have had twelve cases of typhoid fever with two deaths. No cases of diphtheria or scarlet fever have been reported to the board. Three cases of pneumonia in people past middle life occurred, which seemed to point in the direction of the possible contagiousness of the disease under certain circumstances. A fatal case of typhoid fever followed the digging of a barnyard well, the water of which was used for drinking. In the way of suggestions as to methods for improving the sanitary conditions for the town, it seems as if it might not be too much to ask people to stop digging wells in barnyards.

CORINTH.

Members of the board: E. H. Stanhope, M. D., Secretary; C. H. Philbrick, M. D.; Ira W. Davis.

One case of typhoid fever. Pneumonia was more prevalent than usual. Many of the wells are too near the barnyards and privies.

Cornish.

Members of the board: Fred C. Small, Secretary; Wm. B. Swasey, M. D., Chairman; Benj. F. Haley.

There have been three cases of scarlet fever, all ending in recovery. A young man died of diphtheria in Springvale and the remains were brought here for burial. No services were held and the body was carried directly to the cemetery for burial. The persons bringing the corpse went directly home and thoroughly cleansed and disinfected their clothing to avoid the danger of communicating the disease.

We have adopted no by-laws as yet, but we intend to do so, as we begin to feel the necessity for something of the kind. The citizens are beginning to see the good of this work and to appreciate it, which to many, at first, seemed uncalled for. That class of people to-day speak in praise of laws which have been adopted by the State.

Cornville.

Members of the board: D. S. Willey, Secretary; C. E. Smith, Chairman; C. C. Kinsman.

We consider the sanitary condition of our town very good. No cases of the infectious diseases have occurred, but one case was reported to us as scarlet fever and we took precautions against the spread of the disease, but it proved not to be scarlet fever.

Cranberry Isles.

Members of the board: Wm. P. Preble, Esq., Secretary; Wm. E. Hadlock, Esq., Chairman; John Gilley.

No cases of the contagious diseases have occurred. We are exposed more particularly to contagious diseases by vessels harboring here from sickly ports.

Crawford.

Members of the board: J. P. Jeffery, Secretary; N. S. Fenlason Chairman; A. J. Dwelly.

We have had but little sickness and but five deaths, two of which were from consumption and one from spotted fever.

CUMBERLAND.

Members of the board: C. T. Moulton, M. D., Secretary; A. H. Grannell, Chairman; L. H. Merrill.

Our town is composed in part of several islands in Casco Bay. The sanitary condition of the various villages in the town is very good. We have had one case of diphtheria, and three cases of typhoid fever, and in the spring scarlet fever broke out. On account of the mild character of the disease the people were led to be careless in regard to exposure. The outbreaks in the schools were soon brought under control by closing the school. Twenty-three cases of scarlet fever occurred with one death.

CUSHING.

Members of the board: W. B. Bradford, Secretary; Sam'l Payson, Chairman; F. C. Hathorn.

There have been no cases of the infectious diseases.

CUTLER.

Members of the board: C. G. Aldrich, Secretary; M. W. Ackley Chairman; O. A. Davis.

No cases of the contagious diseases. We have had no work on account of so little sickness, but we are always ready when occasion requires.

DAMARISCOTTA.

Members of the board: J. M. King, M. D., Secretary; Jas. Hilton, Chairman; A. H. Snow.

Three or four nuisances, consisting of accumulations of garbage and faulty drains, were reported, and all were removed. There have been no cases of the infectious diseases.

DANFORTH.

Members of the board: M. L. Porter, M. D., Secretary; J. P. Ker, M. D., Chairman; James Carson.

Improvements have been made in the drainage of the village. Twelve nuisances were removed. We have had no infectious diseases excepting measles and whooping-cough.

DAYTON.

Members of the board: Geo. Sylvester, M. D., Secretary; Benj. Whitehouse, Chairman; E. N. Littlefield.

Pneumonia has been more prevalent than any other acute disease. Excepting one fatal case of typhoid fever we have had no infectious diseases. We have endeavored to awaken in the people a sense of individual responsibility, and to impress upon the minds of all the importance of observing sanitary laws, of the danger of the neglect, and the duty of every one to himself, his family, and his neighbor, in preventing and removing all causes of infectious and contagious diseases as far as possible.

Deering.

Members of the board: Geo. P. Sherwood, Secretary; A. P. Topliff, M. D., Chairman; Andrew Hawes.

Fourteen nuisances were reported to the board, twelve of which were removed. We have had two cases of small-pox, the contagion of which was brought from Cumberland Mills; sixteen cases of diphtheria, five of which terminated fatally; four cases of scarlet fever, and four of typhoid fever. When the cases of the infectious diseases have occurred the inspector has visited the house, posted placards, examined the premises, etc. One school-house was condemned as being in an unhealthful condition. Sewerage is needed very much.

Deer Isle.

Members of the board: A. J. Beck, Secretary; Seth Webb, Esq., Chairman; W. B. Thurlow.

We have had twenty-two cases of scarlet fever with one death, and three of typhoid fever with two deaths. All possible precautions are taken to keep infectious disease from spreading.

Denmark.

Members of the board: A. M. Deering, Secretary; S. T. Brown, M. D., Chairman; Joseph Colby.

We have had three cases of diphtheria with two deaths. The contagion seemed to originate from the primary school, the privies of which were very foul. My attention was not called to their condition until the children were taken sick, and then I had them seen to. In the spring measles were prevalent and there were sixty-five or seventy cases.

Dennysville.

Members of the board: A. R. Lincoln, M. D., Secretary; Benj. Lincoln, Chairman; Geo. W. Kilby.

We have had no cases of the infectious diseases. Three nuisances were reported to the board and removed.

DETROIT.

Members of the board: O. J. Dorman, Secretary; D. F. Libby Chairman; Parker Sawyer.

We have had one case of typhoid fever, and measles have been prevalent.

DEXTER.

Members of the board: Cyrus Foss, Secretary; Chas. Hayden, Chairman; Chas. M. Foss, M. D.

There have been four cases of diphtheria with one death, and three of scarlet fever, one of which was fatal. For our municipal year ending March 1st, 1888, there were seventy-eight deaths in town, and for the year ending March 1st, 1889, forty-nine deaths.

DIXMONT.

Members of the board: W. M. Chapman, Secretary; C. W. Prescott, Chairman; H. F. Benson, M. D., Health Officer.

Rheumatism and measles have been prevalent. There are a few wells so located that it is quite probable they contain polluted water. (The secretary sends a sketch showing the relative location of the well, buildings and out-buildings, and the direction in which the ground slopes, from which it would be judged that the well is liable to pollution.—A. G. Y.)

DOVER.

Members of the board; Geo. E. Howard, Esq., Secretary; J. Q. Lander, Chairman; J. B. Cochrane, M. D., Health Officer.

No cases of the infectious diseases have come to the knowledge of the board. A good sewerage system is needed.

DRESDEN.

Members of the board: N. F. Leeman, Secretary; S. D. Houdlette, Chairman; C. J. Chaney.

There have been no cases of the infectious diseases, excepting of measles.

Durham.

Members of the board: J. L. Wright, M. D., Secretary; Rev. C. W. Goddard, Chairman; F. A. Harding.

Two nuisances were reported, but upon notification they were removed by the parties themselves without any action of the board. No contagious diseases have appeared. The diarrhœal diseases of children have been less prevalent than usual. No diseases having been reported we have had to take no action, but we have provided ourselves with the proper papers and hold ourselves in readiness to carry out matters according to the letter of the law when necessary.

Eastbrook.

Members of the board: A. P. Bunker, Secretary; A. W. Googins, Chairman; L. W. Bunker, Esq.

No cases of the infectious diseases have occurred.

East Machias.

Members of the board: Jas. E. Tuell, M. D., Secretary; J. R. Talbot, Chairman; A. J. Hanscom.

No cases of the infectious diseases of the kind specified. Influenza was quite prevalent with a predominance of the gastro-intestinal symptoms, and during the summer a disease which resembled influenza prevailed among horses.

Eastport.

Members of the board: W. F. Cleveland, M. D., Secretary; John Higgins, Chairman; L. K. Corthell.

A system of water works has been put in this last season, but it is not yet complete. Six nuisances were reported to the board, four of which were abated at once; the others were reported so late that it froze before we could see to them. We have had twenty-five cases of diphtheria, and six deaths, and one fatal case of typhoid fever. Cases of the infectious diseases have been isolated, disinfectants employed and houses thoroughly fumigated. Diphtheria entered one of the schools which was closed and the school-room was thoroughly fumigated. We need a system of sewerage.

Eddington.

Members of the board: Wm. E. Merrill, M. D., Secretary; J. J. Temple, Chairman; W. W. Eddy.

One nuisance was removed. Nine cases of diphtheria with two deaths. A young man came from a Massachusetts town to visit relatives. He admits there had been a case of diphtheria in the house from which he came. Soon after his arrival he and others came down with the disease about the same time. We are informed that since then his sister who remained at home has had the same disease. These facts lead us to believe that its prevalence among us was due to importation. The infected were isolated from the healthy in the same families, and infected families were isolated from all other persons as nearly as was possible.

Eden.

Members of the board: W. C. Higgins, Secretary and Chairman; A. P. Cunningham; O. B. Knowles.

The water pipes are now laid from Bar Harbor village to Eagle Lake, a distance of two and one-half miles. The garbage has been hauled nights and mornings to a wharf and dumped into a scow in which it is towed three miles out to sea and dumped. It has not been washed ashore again. About forty nuisances were reported and all of them were promptly removed. We had three cases of diphtheria with one death, three of scarlet fever all of which recovered, and thirteen cases of typhoid fever with one death. Cases of infectious diseases have been carefully isolated.

Edgecomb.

Members of the board: Eben Chase, Jr., Secretary; Jos. A. Merry, Chairman; A. M. Burnham, Esq.

There have been no cases of the infectious diseases. The one nuisance which was reported to the board was quietly disposed of without expense.

Eliot.

Members of the board: Albert Lord, Esq., Secretary; J. L. M. Willis, M. D.

This town has been remarkably free from diseases.

Ellsworth.

Members of the board: J. Herbert Patten, Secretary; Walter M. Haynes, Chairman.

Four nuisances were reported to the board, two of which were removed and one remedied. No infectious diseases. We need a

good water supply and an efficient system of sewerage. One case of drowning occurred.

Embden.

Members of the board: Cephas Walker, Secretary; Randall Durrell, Chairman; J. W. Morin.

One case of typhoid fever occurred. Diphtheria has been less prevalent than usual. There is need of guarding well our water supplies from pollution.

Enfield.

Members of the board: T. S. Laing, Secretary; A. J. Darling, Chairman; J. R. M. Gilman.

Our people have generally been very healthy and we have had no infectious diseases excepting German measles.

Etna.

Members of the board: S. J. Locke, Secretary and Chairman; Jas. Goodell; E. E. Sylvester.

We have had two cases of typhoid fever, both of which were imported, one from Bangor and the other from Lewiston. The patients were promptly isolated and disinfection of clothing and excreta was carried out. One death occurred from being run over by the cars.

Exeter.

Members of the board: S. W. L. Chase, M. D., Secretary; E. A. Chandler, Chairman; W. F. Hart, M. D.

We have had three fatal cases of diphtheria, and one case of typhoid fever. One of the cases of typhoid fever was apparently caused by drinking impure cistern water. One case of glanders occurred in a horse.

Fairfield.

Members of the board: T. G. Heald, Secretary; F. J. Robinson, M. D., Chairman; Frank J. Savage.

Two cases of diphtheria have been reported to the board, one of which proved fatal, and there have been two cases of typhoid fever. Whenever complaints of nuisances have been made we have attended to them and as far as we could we have had the causes removed. We have not been able to do very much on account of

the want of drainage, and this has got to be done before many of the infected places can be cleared out.

FALMOUTH.

Members of the board. A. S. Noyes, Secretary; W. K. Swett, Chairman; H. J. Merrill.

There have been three cases of typhoid fever which were confined to one family.

FARMINGDALE.

Members of the board: F. M. Putnam, M. D., Secretary; A. C. Stilphen, Chairman; A. B. McCausland.

Some improvements in drainage and sewerage have been made by the board, but we need a regular system of sewerage for that part of the town on the main street facing the river. Several nuisances have been promptly removed. The town has been remarkably free from contagious diseases. None have been reported.

FARMINGTON.

Members of the board. F. O. Lyford, M. D., Secretary and Health Officer; Capt. C. W. Keyes, Chairman; H. W. Lowell.

We have expended about six hundred dollars improving the drainage of the village. Twelve nuisances were reported and all but one were removed. We have had two cases of diphtheria with one death, and four of typhoid fever with two deaths. Infected houses have been placarded and persons have been prohibited from going near infected places. All infected places have been disinfected.

FAYETTE.

Members of the board: J. S. W. Hewett, Secretary; H. I. Wing, Chairman; A. F. Watson.

There have been no cases of the infectious diseases.

FRANKLIN.

Members of the board: F. H. Tucker, Secretary; O. C. Donnell, Chairman; C. T. Bunker, M. D., Health Officer.

We have had six cases of typhoid fever with one death. The cases of fever were isolated and disinfection was carried out.

Freedom.

Members of the board: J. W. Mitchell, M. D., Secretary; C. E. Smith, Chairman; D. B. Johnson.

There have been no cases of the infectious diseases.

Freeman.

Members of the board: A. W. Mayo, Secretary; N. Peterson, Chairman; John B. Carvill.

Four cases of typhoid fever occurred in one house, but they were not reported by the physician until the patients were out of danger. One nuisance was removed.

Friendship.

Members of the board: E. E. Baker, M. D., Secretary; Nelson Thompson, Chairman; Cyrus Delano.

We have had no cases of contagious diseases, except two cases of typhoid fever. One of these could be traced to no source, and the other was brought from a neighboring town.

Fryeburg.

Members of the board: Thos. C. Shirley, Secretary; D. L. Lamson, M. D., Chairman; Irving Mabry, M. D.

There was one case of scarlet fever, which was isolated at once. One nuisance was removed. Sewerage is needed in the village.

Gardiner.

Members of the board: E. E. Lewis, Secretary; W. P. Giddings, M. D., Chairman; V. R. Beedle.

We have a partial system of sewerage, but as yet it is very incomplete and correspondingly unsatisfactory. Additions to it and improvements of it are being made every year as the means at our disposal will allow. We have great natural advantages for drainage by reason of the formation of the ground and numerous water courses within the city limits which have been taken advantage of in a temporary manner until such time as we shall see a complete and permanent system of sewerage established. Three thousand feet of sewers have been put in this year of the best material and in the best manner.

Sixty-eight nuisances have been reported and all have been removed by the persons responsible for them. The people co-operate with us more heartily and adopt our suggestions more readily as they become better acquainted with, and see the necessity of improvements in our sanitary arrangements.

We have had eleven cases of diphtheria with four deaths, two cases of scarlet fever and one of typhoid fever. In connection with cases of the infectious diseases the premises have been promptly isolated, both written and verbal instruction given, disinfectants furnished and a faithful and competent officer placed in charge to see that all the conditions were complied with.

The second case of diphtheria reported this year was of a little girl who, the evening before she was taken sick, was at a neighbors playing with other children. There was present a young man from Hallowell and during the evening the little girl complained of feeling ill and the young man took her in his lap and held her for a short time, when she felt better and went home. The next morning she was sick with diphtheria in one of its most malignant forms and died on the fourth day. The young man returned to Hallowell and in eight or nine days came down with diphtheria and was very sick. Two other cases occurred in the same house at Hallowell. The three children with whom this little girl played all had severe sore throats of a diphtheritic character about the same time. The parents were forewarned and precautions and prompt action was taken.

GARLAND.

Members of the board: F. A. C. Emerson, M. D., Secretary; E. L. Oak, Chairman; Mark Jennings.

One case of typhoid fever occurred. The sink drain nuisance is our worst failing. I believe the only practicable way to dispose of it is to collect the slops in suitable vessels, and have them removed every day or two, and utilized as fertilizers, disinfecting the vessels frequently. Two cases of tuberculosis occurred in cows, and we had one case of glanders.

GEORGETOWN.

Members of the board: John L. Berry, Secretary; S. P. Oliver, Chairman; Benj. Rowe.

Only one nuisance was reported and this was removed. We had twenty cases of diphtheria with two deaths from this cause. The

law has been complied with by the board. Sixteen dwelling houses and school-houses were cleansed and disinfected.

Gilead.

Members of the board: A. M. Whitman, Secretary; E. E. Kimball, Chairman; E. Harriman.

No cases of the infectious diseases have occurred.

Glenburn.

Members of the board: F. L. Brown, Secretary; Fied Cort, Chairman; Elisha Hill.

There have been five cases of pneumonia with two deaths, but there have been no cases of contagious diseases.

Glenwood Plantation.

Members of the board: A. Springer, Secretary; I. P. Pierce, Chairman; J. E. Pierce.

There were no cases of contagious diseases excepting a few of whooping-cough and measles.

Gorham.

Members of the board: G. W. Heath, Secretary; A. W. Lincoln, M. D., Chairman and Health Officer; Caleb G. Carver.

We have had seven cases of scarlet fever and three of typhoid fever. All diseases of a contagious character are promptly reported by the physicians, the patients are isolated as much as possible from the rest of the family, admittance given to none except the physician and attendants, and persons are strictly forbidden from visiting infected houses, and members of the infected families are cautioned against having communication with other families.

The work of the board during the past year has not been so difficult as it was the preceding year, for a better understanding, by the people, of the law regulating boards of health has prompted them to observe those duties incumbent upon every good citizen desirous of aiding in sanitary work. Not having been visited by any epidemic during the past year as was our misfortune the year before, the work of disinfection and fumigation has been very much less, and in cases where these measures were necessary to be carried out, there was a willingness on the part of those exposed to

use all means at their command to prevent the further spread of the contagion. We can but hope that as each city or town begins to regard the lives and health of its citizens as so much wealth or property entrusted to its care, there will be a continued progress in sanitary reform.

GOULDSBORO.

Members of the board: T. R. Hammond, Secretary; C. C. Larrabee, M. D., Health Officer; R. J. Joy, Chairman.

No contagious diseases have occurred.

GRAY.

Members of the board: E. T. Andrews, M. D., Secretary; E. A. McCollister, M. D., Chairman; Dr. J. F. Rowell.

We have had four cases of diphtheria, two of scarlet fever and four of typhoid fever. Two of the typhoid patients died. In connection with cases of the infectious diseases, the secretary of the board has visited the cases and instructed the friends in regard to the isolation of the patient, has left with them the circulars published by the State Board of Health relating to the disease in question, and has afterward seen that the disinfection was properly carried out.

In one fatal case of typhoid fever the patient came home from Sebago Lake, in the town of Standish, sick with the disease, where he had been at work in a saw mill. The patient and his friends attributed the cause of the disease to drinking the water from a well which they say was situated near the stable and sink spout, and on a lower level than either so that it received the drainage from both. They informed me that there had been nine cases of typhoid fever in this one mill, apparently from the same cause.

GREENBUSH.

Members of the board: H. F. Harris, Secretary; Melvin J. Harris; W. W. Harris.

There have been two cases of typhoid fever. One case of drowning occurred. One nuisance was abated.

GREENE.

Members of the board: J. E. Sawyer, Secretary; E. L. Mower, Chairman; Alden Sawyer.

We have had one fatal case of diphtheria and ten cases of scarlet fever in which all the patients recovered. We would suggest that physicians and householders notify us immediately after the breaking out of infectious diseases, which they have failed to do.

Greenville.

Members of the board: F. W. Knowlton, Esq., Secretary; H. A. Sanders, Chairman; H. Hunt, Jr., M. D., Health Officer; Leonard R. Young.

Water is brought into the town from a spring a mile from the village and next spring it will be put into the houses. Six nuisances were reported all pertaining to matters easily removed. There have been nineteen cases of diphtheria with seven deaths, four of scarlet fever with no deaths, and fifteen of typhoid fever, none of the cases of which were fatal. The diphtheria outbreak originated in a filthy railroad camp where the first two cases appeared.

Greenwood.

Members of the board: Walter B. Rand, Secretary; Jos. A. Fairbanks, Chairman; Wm. Richardson.

One case was attended to by the board which was reported as cholera, probably cholera morbus. Samples of water have been forwarded to the secretary of the State Board of Health for analysis.

Guilford.

Members of the board: Z. L. Turner, Secretary; L. H. Whittier, Chairman; Henry Straw; C. M. Hussey, M. D., Health Officer.

We had six cases of diphtheria all of which recovered. We placarded infectious houses and distributed liberally the special disease circular on diphtheria.

Hallowell.

Members of the board: J. M. Eveleth, M. D., Secretary; J. T. Chase, Chairman; E. W. Maddox.

Three formal reports were made of nuisances. Some complaints have been made of the sewers which it was impossible to abate without a better supply of water. There have been fifty-five cases of diphtheria with eleven deaths, and five cases of typhoid fever with one death. In cases of the infectious diseases we have always

visited the house, but in some cases I have left the carrying out of the preventive measures with the attending physician. Our directions have generally been followed, but we have found some who were much more ready than others to use proper precautionary measures themselves. Sickness was caused in one family by coal gas. Better drainage and a better water supply are needed.

In one small locality a mild case of sore throat to which no physician was called appeared to be the origin of nine cases of diphtheria, three of which proved fatal.

HAMPDEN.

Members of the board: W. H. Nason, M. D., Secretary; C. F. Cowan, Chairman; Hon. H. W. Mayo.

We have had three cases of diphtheria, one of which was fatal, and one case of typhoid fever ending in recovery. We have had improvements made in the condition of the vaults in the out-buildings of school houses. One family consisting of mother and three children were made sick and were attacked with purging and some vomiting after eating cookies which had been purchased from a baker.

HANCOCK.

Members of the board: A. B. Crabtree, Secretary; Marcus Mullen, Chairman; R. H. Young.

No cases of the infectious diseases.

HANOVER.

Members of the board: J. B. Roberts, Secretary; J. R. Howard, Chairman; A. T. Powers.

We have had nothing in the way of infectious diseases, excepting two mild cases of scarlet fever. A physician was not in attendance for several days, but the family reported the cases themselves. We at once placarded the house and left the proper circulars which give directions in regard to the preventive management and requested that they be as closely observed as possible.

HARPSWELL.

Members of the board: Jas. S. Farr, Secretary; Geo. H. Dearbourn, Chairman; John M. Stinson.

Some improvements have been made in the drainage and water supply. Four nuisances were reported to the board and were removed by the parties on notification. One case of typhoid fever occurred.

Harrison.

Members of the board: Alphonso Moulton, Secretary; S. L. Weston, Chairman; H. H. Cole, M. D.

One nuisance was removed. There were eleven cases of scarlet fever, but no deaths. Rheumatism, lung troubles, and jaundice have been unusually prevalent, due perhaps to the damp weather. Cases of the infectious diseases have been isolated at once and due notice given to the public. There is one tenement house in which there is almost always one or more cases of throat or lung trouble. The unhealthfulness is probably caused by bad drainage, impure water and offensive privies.

Scarlet fever broke out in three different families on the same day, and there had been no previous cases and no known exposure.

In one family a part of the children had previously had scarlet fever. The children owned a box of toy tools and before the house was fumigated this box of tools was carried to a chamber in an adjacent shed. Some two months after the disease had disappeared one of the boys of this family took the box of tools out and he and a neighbor's boy played with them. In three days time the neighbor's boy was taken with scarlet fever, caught, in all probability, from those tools.

Hartland.

Members of the board: A. W. Miller, Secretary; E. A. Bean, M. D., Chairman; J. F. Brawn, M. D.

Haynesville.

Members of the board: W. H. Chambers, Jr., Secretary; A. G. Chambers; J. H. Brown.

There have been no cases of the infectious diseases.

Hebron.

Members of the board: F. C. Donham, M. D., Secretary; H. A. Cushman, Chairman; F. R. Glover.

We have had one case of diphtheria and two of scarlet fever. Three nuisances were reported and were quickly and willingly removed when proper notice was given to the parties.

Our board inspected the rooms, privy vaults, sink drains, etc., of every building in the village where rooms were rented to academy scholars, or where boarders were taken. Wherever we advised changes to be made in sink drains, or privy vaults, or rooms to be properly washed and cleansed, the owners of the buildings responded quickly and willingly. The board has to express its satisfaction and thanks to the people for the willingness shown in acting promptly upon our suggestions, and for their kindness in making it unnecessary for us to take any action in any instance further than to advise. One well of water has been condemned for drinking purposes.

Hermon.

Members of the board: F. P. Whittaker, Secretary; F. A. Bishop, Esq., Chairman; J. W. Tuesley.

Reports were received of two cases of nuisance and they were removed. We have had two cases of scarlet fever and two of typhoid fever without any deaths from either. One case of typhoid fever was without doubt caused by the drinking water. Other cases of the same disease had been in the same house. The privy was within ten feet of the well and had not been cleaned for over a year.

Hiram.

Members of the board: C. E. Wilson, M. D., Secretary; A. K. P. Googins, Chairman; Samuel D. Wadsworth.

One case of diphtheria and three of typhoid fever occurred. Two nuisances were removed. Consumption is a very common disease in this section and I am convinced from my own experience that it is time that patients were as perfectly isolated in this disease as in any of the other contagious diseases.

Hodgdon.

Members of the board: Moses Benn, Secretary; Jas. V. Tabor, M. D. Chairman; Wm. A. Atherton.

We have had two cases of diphtheria with no deaths resulting, and two cases of typhoid fever, both of which had a fatal termination. In addition measles have prevailed. The unusual healthiness of our citizens has left but little work to be done by the board.

HOLDEN.

Members of the board: P. L. Pond, Secretary; Geo. C. Wiswell, Chairman; A. Tirrill.

We have had two cases of diphtheria, and one of typhoid fever. May 14th the board of health was notified that a trunk containing the clothes of a man that died with small-pox in Boston had been brought into the town and left at the house of his brother. The board of health took means at once to have the trunk and clothing disinfected and we received no injury from them. (The prompt action of the local board was creditable to them, but with clothing infected with small-pox virus there was considerable risk in saving the clothing unless the disinfection was done by an expert in the business. Under the circumstances burning or thorough boiling would be the safest practice.—A. G. Y.)

HOLLIS.

Members of the board: Thos. J. Carle, Secretary; Jos. L. Smith, Chairman; E. E. Abbott.

We have had no infectious diseases except four cases of scarlet fever. Isolation and disinfection were practised and the disease was confined to the one family infected.

The school-rooms as a general thing are heated by stoves with the funnel running overhead. When the heat becomes unbearable windows are thrown open and the cold air rushes in and the result is the scholars are attacked with colds and coughs, many times so as to keep them from school. I think that a copy of the annual report of the State Board of Health on the desk of every school-room, and the teacher's attention called to it, would be a good invention as regards the health of our children.

HOULTON.

Members of the board: Chas. E. Williams, M. D., Secretary; Lewis B. Johnson, Chairman; Geo. Cary, M. D.

About fifty nuisances have been attended to. There have been eight cases of diphtheria with no deaths, and seven of typhoid fever with two deaths. Cases of the infectious diseases are immediately isolated by a personal visit and afterwards careful disinfection is practised. Diarrhœal and dysenteric troubles were prevalent and we had an epidemic of measles and German measles.

HOWLAND.

Members of the board: O. C. Swett, Secretary; J. O. Davis, Chairman; R. Q. Lancaster.

We have had no cases of the infectious diseases.

HURRICANE ISLE.

Members of the board: T. W. Sullivan, Secretary; John Donohue, Chairman; T. F. Haley.

No cases of the infectious diseases have occurred.

ISLAND FALLS.

Members of the board: Geo. H. Donham, Secretary; Alpheus Craig, Chairman; M. L. Emerson.

We have had five cases of diphtheria with three deaths. Measles, whooping-cough and erysipelas have also been prevalent.

ISLESBORO.

Members of the board: Jos. A. Sprague, Secretary; Nelson Gilkey, Chairman; W. S. Pendleton.

Excepting measles and one case of scarlet fever we have had no prevalence of infectious diseases.

JACKSON.

Members of the board: D. D. Gould, Secretary; J. H. Cook, Chairman; J. Jacobs, M. D., Health Officer.

We have had no cases of the infectious diseases, excepting one of diphtheria.

We have had seven cases of typhoid fever, one of which was fatal. One of the cases of typhoid fever was caused apparently by water which had the soakage of a sink drain.

JAY.

Members of the board: S. B. Farnum, Secretary; Warren Leland, Chairman; E. W. Gould.

JEFFERSON.

Members of the board: J. J. Bond, Secretary; A. A. Jackson, M. D., Health Officer.

We have had two cases of diphtheria and three of typhoid fever. The vacancy in the board was occasioned by the death of Mr. J. H. Noyes who was a member of the board.

JONESBORO.

Members of the board: E. M. Watts, Secretary; Ansel Tupper Chairman; Edwin Varney.

We had one case of scarlet fever ending fatally. Careful isolation was maintained and a thorough disinfection was carried out.

JONESPORT.

Members of the board: J. W. Peasley, Secretary; Justus W. Bickford, Jr., Chairman; Eugene L. Kelley.

We have had one case of diphtheria, twenty-seven of scarlet fever, and two of typhoid fever with one death from each of the last two diseases. Scarlet fever has been in town several years and perhaps from the want of a more careful disinfection of the premises, heretofore.

KENNEBUNK.

Members of the board: Walter L. Dane, Esq., Secretary; Frank M. Ross, M. D., Chairman; John Cousens.

We have had five cases of scarlet fever, and four of diphtheria, with one death from each disease. Cases of the infectious diseases have been isolated, private funerals are insisted upon if death should occur, and twice the schools have been closed. We have attended promptly to our duties and can report the best of results from the isolation of the cases. Several nuisances have been reported and have been removed by their owners.

KENNEBUNKPORT.

Members of the board: Wm. H. Cluff, Secretary; D. F. Barrett, M. D., Chairman.

We have had eleven cases of diphtheria with two deaths, and seventeen of scarlet fever with one death. A number of cases of diphtheria have not been reported and two deaths resulted from the unreported cases. One nuisance was reported and that was abated.

KINGFIELD.

Members of the board: C. W. Clark, Secretary; Wm. S. Gilbert, Chairman; C. O. Wilkins.

We have had no infectious diseases until at the time of making this report one case of diphtheria has appeared. The case appeared in a hotel, and we removed the patient to a farm house three-fourths of a mile from the village, where he will be attended by nurses. There was no family in the house to which we moved the patient. The infected house was placarded and the hotel was thoroughly fumigated with sulphur, and disinfected with corrosive sublimate solution and chloride of lime.

KITTERY.

Members of the board; L. O. Buzzell, M. D., Secretary; M. F. Wentworth, M. D., Chairman; A. W. Johnson, M. D.

No cases of the infectious diseases have been reported to this board. An epidemic of jaundice appeared, but respecting the causation of it I have formed no opinion.

LAGRANGE.

Members of the board: J. H. McGregor, M. D., Secretary; H. W. Blake, Chairman; Wm. B. Danforth.

One case of typhoid fever occurred.

LAMOINE.

Members of the board: W. S. Hodgkins, Secretary; E. H. King, Chairman; I. N. Salisbury.

We have had two cases of typhoid fever.

LEE.

Members of the board: J. M. Daniels, Secretary; Albert K. Lewis, Chairman; O. I. Getchell.

Two nuisances were reported to the board and were removed immediately by their owners when notified to do so. We have had two cases of diphtheria and one of the patients died. The infected houses were placarded, circulars were distributed among the neighbors, and all possible precautionary measures were taken. I worked hard and spent much time with the diphtheria cases, and

think by so doing the disease was kept from spreading; at any rate, I can learn nothing more of its prevalence in town.

LEEDS.

Members of the board: H. M. Brewster, Secretary; Albert Barker, Esq., Chairman; R. S. Loring, M. D.

There has not been a case of contagious disease in the town during the year. Among cattle one case of tuberculosis occurred. The ox was killed and the disease did not spread.

LEVANT.

Members of the board: C. W. Fernald, Secretary; C. M. Page, Chairman; A. M. Purinton, M. D.

No cases of the contagious diseases have occurred.

LEWISTON.

Members of the board; C. V. Emerson, M. D., Secretary; O. A. Horr, M. D., Chairman; J. A. Donovan, M. D.

Our sewerage has been extended, otherwise there has been no improvement of disposing of excreta. Thirty-nine nuisances of a more aggravated form were reported to the board and several lesser ones. Nearly all were remedied or abated entirely. Four cases of diphtheria, twelve of scarlet fever, and sixteen of typhoid fever have been reported to the board. Scarlet fever has been more prevalent than in many years, and I think the extremely mild type of the disease has had much to do with its prevalence. One family had the disease (believed to be such), not knowing what it was, while the children played out doors most of the day. The neighboring families having the disease in a severer form led to the discovery that family number one had had it.

LIBERTY.

Members of the board: Geo. F. Hunt, Secretary; A. A. Brown, Chairman; E. A. Porter, M. D.

We observe that the public laws with reference to the work of State and local boards of health, so far as this community is concerned, have resulted in much good, already, causing more vigilance on the part of the people in matters of sanitary importance, just in proportion as they are educated to the importance of the work being

done by the State and local boards. Our opinion is that the "Sanitary Inspector," or some other good sanitary journal, ought to be placed in every home of this State at the public expense, as an educator in sanitary matters which are of such vital importance to public and private interests. We have had no cases of the infectious diseases.

LIMESTONE.

Members of the board: A. D. Hatfield, Secretary; E. G. Weymouth, Chairman; M. Trafton.

Measles, whooping cough and chicken pox have been prevalent.

LIMINGTON.

Members of the board: W. S. Small, Secretary; S. M. Bradbury, Chairman; J. F. Moulton, M. D.

One nuisance was removed. We have had one non-fatal case of diphtheria, and seven cases of typhoid fever, two of which ended fatally. Cases of the infectious diseases have been immediately attended to.

LINCOLN.

Members of the board: C. Fuller, M. D., Secretary; C. A. Sargent, Chairman; J. M. Adams.

Four nuisances have been reported to the board. The one south of the hotel which was inspected by the Secretary of the State Board still remains unabated. Two cases of diphtheria and two of typhoid fever have come to my personal knowledge, but no disease has been reported by any physician, though they have received the proper blanks and notices.

LINCOLNVILLE.

Members of the board: E. F. Brown, M. D., Secretary; R. B. Sherman, Chairman; H. A. Pierce.

Sewers have been put in and the excreta has been very well disposed of. Three nuisances have been reported and all were removed without any trouble. We have had three cases of diphtheria, five of scarlet fever, and two of typhoid fever, but no deaths resulted. Measles were prevalent. One death in the case of a young man about twenty years of age occurred by drowning, and at the present time I am in attendance on a very serious case of accidental shooting.

LINNEUS.

Members of the board: Robert Boyd, M. D., Secretary; Jas. F. Bither, Chairman; Rufus B. Young.

We have had one case of diphtheria and two of typhoid fever. Dysentery was unusually prevalent, the cause of which I cannot determine. In one locality it appeared contagious. Whooping cough also prevailed quite extensively.

LISBON.

Members of the board: John W. Jordan, Secretary; N. J. Shaw, Chairman; A. W. Potter, M. D., Health Officer; C. B. Plummer.

Eight nuisances have been reported to the board and all were removed; some, however, at the expense of the town, but the property paid the bills. In Lisbon village the sewer has been extended. We have had thirteen cases of diphtheria with four deaths and two rather mild cases of scarlet fever. Pneumonia and mumps have also been prevalent. In connection with cases of contagious diseases the infected families have been isolated during the period of the disease and disinfection has been done. Three of the cases of diphtheria seemed to have been caused by the sink drainage running under the house and collecting under the living rooms. We had the trouble remedied.

LITCHFIELD.

Members of the board: G. Roberts, Jr., Secretary; Enoch Adams, M. D., Chairman; Thos. Holmes, Esq.

Two nuisances were reported to the board and they were readily abated by notifying the parties. We had one case of typhoid fever. The diarrhœal diseases were less prevalent than usual. We have done no special work, but the fact that a board of health was in existence has made many persons more careful than usual in regard to nuisances.

LITTLETON.

Members of the board: L. F. Hall, Secretary; G. C. Heyward, Chairman; Henry A. Hall.

One nuisance was removed. We have had no cases of the infectious diseases.

LIVERMORE.

Members of the board: W. F. Fuller, Secretary; Eli Edgecomb, M. D., Chairman; R. B. Bradford.

Three cases of typhoid fever, two of which were contracted in an adjoining town. One case ended fatally.

LOVELL.

Members of the board: C. P. Hubbard, M. D. Secretary; W. W. Durgin, Chairman; Rev. J. W. Webster.

We have had three cases of typhoid fever. The patients were isolated, the discharges were disinfected and buried and after recovery the clothing and bedding were disinfected. Jaundice has been quite prevalent.

The cases of typhoid fever were at North Lovell and were due, I think, to the bad drinking water. The water is obtained from wells which receive all the surface water as the ledge is very near the surface. From the north end of the village southward the ground descends, therefore the water from the upper end of the village passes through each well in succession. In the summer season the water is not palatable. Our drinking water supply should be brought from the side of the mountain in an aqueduct.

LUBEC.

Members of the board: Ira W. Hamilton, Secretary; James B. Neagle, Chairman; Samuel Mears.

We have had three cases of diphtheria, eight of scarlet fever, and one of typhoid fever.

MACHIASPORT.

Members of the board: F. L. Shaw, M. D., Secretary; E. A. Moore, Chairman; C. W. Gates.

We have had sixteen cases of scarlet fever with three deaths, and ten cases of typhoid fever, none of which were fatal. Most of the cases of typhoid fever came from a well on Ingall's Island. Two years ago there was a case of typhoid fever there and the medical attendant did not disinfect the stools. I think the rainy season washed the germs into the well. One death occurred from drowning, and one from inhalation of coal gas.

MADISON.

Members of the board: W. G. Sawyer, M. D., Secretary; C. D. Morrill, M. D., Chairman; J. F. Chadbourne.

Three nuisances were reported to the board, two of which were removed. We have had three cases of diphtheria and five of typhoid fever, none of which were fatal. Three of the cases of typhoid fever and a number of cases of diarrhœal diseases all in one building were due to contamination of the water supply. The cases ceased after the recommendations of the board were carried out. One case of drowning occurred by a boy two years of age falling into the water which filled an excavation at the side of the road.

MADRID.

Members of the board: J. L. Witham, Secretary; A. J. Hewey, Chairman; Reuben Sargent, Esq.

One nuisance was reported to the board and upon notification the owner partly removed the trouble. For contagious diseases we have had only one case of typhoid fever. The board visited the house in regard to the use of disinfectants and the burial of excreta, and no other case occurred in the family.

MANCHESTER.

Members of the board: G. M. Knowles, Secretary; W. R. Merrill, Chairman; F. J. Hewins.

There has not been a case of contagious disease in the town during the year.

MAPLETON.

Members of the board: J. C. Chandler, Secretary; J. A. Stewart, Chairman; A. J. Alley.

Otherwise than for the prevalence of measles we have been blessed with health and cleanliness.

MARIAVILLE.

Members of the board: B. G. Young, Secretary; M. Kingman, Chairman; E. G. Brimmer.

We have had no cases of infectious diseases. We have had three cases of diphtheria.

Marion.

Members of the board: Benj. L. Smith, Secretary; Jos. Thompson, Chairman; F. N. Gardner.

We had one case of diphtheria, and for the purpose of restricting it to this primary case we placarded the house and kept all the neighbors from the infected building.

Masardis.

Members of the board: F. H. Knowlen, Secretary; F. W. E. Goss, Chairman; S. W. Clark.

We have had six cases of typhoid fever, with one death at a late stage. At the time of making this report there is one case in the same house. The people are very careful and are taking every precaution.

Mason.

Members of the board: Rev. A. H. Witham, Secretary; E. Hutchinson, Chairman; H. G. Mason.

We have had one case of diphtheria, and in connection with it we placarded the house, warned the people and enjoined precaution on the part of the family. Measles was also quite prevalent, but not in a severe form.

Mattawamkeag.

Members of the board: Geo. W. Smith, Secretary; Jas. H. Hamilton, Chairman; Alexander McClain.

We have had nine cases of diphtheria with three deaths.

Maxfield.

Members of the board; Chas. J. Cummings, Secretary; John Smart, Chairman; Geo. Emery.

We have had no cases of the infectious diseases. We have been blessed with excellent health. I wish to say that we all appreciate the efforts of your board and hope you can continue your noble work.

Meddybemps.

Members of the board: John S. Bridges, Secretary; Chas. L. Hatter, Chairman; S. J. Allen.

There have been no cases of any of the serious infectious diseases.

Medford.

Members of the board: S. O. Dinsmore, Secretary; A. A. Bailey, Chairman; W. S. Lovejoy.

We have had no cases of the infectious diseases. We investigated one nuisance and found the privy within twelve feet of the well from which the family obtained their drinking water. We caused its immediate removal.

Medway.

Members of the board: C. A. DeGrass, Secretary; N. A. Powers, Chairman; W. H. York.

We have had two fatal cases of diphtheria.

Mercer.

Members of the board: D. G. Wood, Secretary; John Bunker, Chairman; Eli Wells.

We have had no infectious diseases.

Mexico.

Members of the board: Henry W. Park, Secretary; Geo. H. Gleason; L. C. Willoughby.

There have been no cases of the infectious diseases.

Milbridge.

Members of the board: Geo. Googins, M. D., Secretary; L. G. Means, Chairman; Geo. A. Sawyer, M. D.

The water supply is mostly from aqueducts with some cisterns and a few wells. We have had thirty cases of diphtheria with four deaths, and one non-fatal case of typhoid fever. We could trace the origin of some of the diphtheria cases and in some of the others we could not.

Milford.

Members of the board: M. W. Sawyer, Secretary; M. A. Austin, Chairman; F. P. Oliver.

There is no change in the water supply except the larger supply than usual from the heavens. Two nuisances were removed. We have had no cases of infectious diseases. We have done nothing worth mentioning, but for special work we think we have done especially well to do as well as we have.

Milo.

Members of the board: A. W. Murray, Secretary; M. L. Durgin, Jr., Esq., Chairman; H. Hamlin, M. D.

We have had two cases of diphtheria with no deaths, and five cases of typhoid fever with two deaths. One nuisance was removed.

Minot.

Members of the board: C. M. Cobb, M. D., Secretary; E. F. True, Chairman; Chas. H. Tobie, M. D.

Five nuisances have been reported, all of which have been attended to. We have had several complaints regarding a tenement house in which typhoid fever has occurred several times. The owner was disposed to do all in his power, but as there is no drainage and no way of having it without a large outlay, we ordered him to disinfect with fresh earth and chloride of lime, which was done daily.

We have had two cases of diphtheria with no deaths, and ten of typhoid fever with three deaths. One death occurred from drowning. We are badly in want of a better water supply. The physicians have done a great deal to help the board, and the citizens are ready and anxious to do all in their power to improve their surroundings.

Monmouth.

Members of the board: D. E. Marston, M. D., Secretary; Jesse Jeffrey, Esq., Chairman; O. W. Andrews.

One case of typhoid fever was reported to the board.

Monson.

Members of the board: C. W. Ray, M. D., Secretary; E. R. Haynes, Chairman; F. J. Wilkins.

One nuisance was examined by the board and caused to be removed. Several privies and sink spouts have also been improved at our request, and very willingly on the part of the owners when their attention was called to them. We have had two cases of diphtheria and one of typhoid fever with no deaths from either disease. The first case of diphtheria must have been caused by contagion which had remained in the house where there had been two cases of diphtheria one year before. The second case resulted

from carelessness in disinfecting the clothing of the first patient. One girl stayed over night in a house in a neighboring town where there was a case of diphtheria. On her return to this town we had herself, her clothing and everything with which she had come in contact since her return thoroughly disinfected, and kept her out of school a week.

MONTICELLO.

Members of the board: Robt. W. McLeod, Secretary; M. J. Hogan, Chairman; Enoch Robertson.

It has been a comparatively healthy year and no contagious diseases have been reported to us.

MONTVILLE.

Members of the board: A. D. Ramsay, M. D., Secretary; C. T. Randall, Chairman; B. F. Foster.

No contagious disease has been reported to the board.

MORRILL.

Members of the board: J. W. Pearson, M. D., Secretary; J. R. Mears, Chairman; D. O. Bowen.

No infectious diseases have occurred.

MOSCOW.

Members of the board: A. Burke, Secretary; C. M. Hill, Chairman; Thos. Emerton.

No contagious diseases have occurred. There are no unhealthy localities in our town except where the water supply is located below the buildings where the stable or privy have free drainage into it. Such a mistake, I see, is surprisingly prevalent.

MT. CHASE.

Members of the board: E. A. Cooper, Secretary; John Sargent, Chairman; Leslie Tozier.

There have been no cases of contagious diseases.

MT. DESERT.

Members of the board: Sam'l M. Nash, Secretary; B. T. Atherton, Chairman; W. S. Smallidge.

We have had three cases of diphtheria.

Mt. Vernon.

Members of the board: Silas Burbank, M. D., Secretary; R. F. Fletcher, Chairman; Jas. A. Robinson.

We have had three cases of diphtheria and one of typhoid fever, all of which recovered.

Naples.

Members of the board: Philip O. Cannell, Secretary; Geo. W. Hall, Chairman; Chas. Y. Lord, M. D.

We have had one case of scarlet fever and two of typhoid fever. One of the typhoid cases ended fatally. Three nuisances were reported and removed.

Newburgh.

Members of the board: C. H. Whitcomb, Secretary; B. D. Newcomb, Chairman; F. O. J. S. Hill.

We have had no infectious diseases excepting measles.

Newcastle.

Members of the board: S. D. Wyman, Secretary; R. C. Chapman, M. D., Chairman; A. W. Glidden.

There have been no cases of the infectious diseases.

Newfield.

Members of the board: I. M. Trafton, M. D., Secretary; Chas. L. Wentworth, Chairman; Thos. E. Mitchell.

One case of scarlet fever was imported, but was immediately isolated and the disease did not spread. One case of what was supposed to be glanders in a horse resulted in the killing and burying of the horse and disinfection of the stable.

New Gloucester.

Members of the board: J. I. Sturgis, M. D., Secretary; Alvin Brown, Chairman; M. C. Clark.

One case of scarlet fever occurred.

New Limerick.

Members of the board: Jos. A. Grant, Secretary; F. L. Dyer, Chairman; C. A. Sheldon.

We have had no cases of the infectious diseases.

NEWPORT.

Members of the board: F. M. Shaw, Secretary; R. H. Libbey, Chairman; A. I. Harvey, M. D., Health Officer.

In two instances the board caused the removal and burial of dead animals. Several vaults have been cleaned by the direction of the board. Our attention has been called to three cases of typhoid fever, all of which were attended to immediately. Several cases of measles occurred. Our most serious difficulty in this town comes from the country privy vaults and barnyards which are usually situated much too near the wells from which the family water supply is drawn, and sometimes the well water smells of the sink drain. Attention has been drawn to these things and in some instances with good results.

NEW PORTLAND.

Members of the board: W. H. Stevens, M. D., Secretary; S. A. Bennett, M. D., Chairman; Abel Thompson.

Two nuisances were removed. Six cases of typhoid fever occurred, two of which were fatal. In connection with these cases the dejections were buried and all excreta-soiled bedding and clothing were disinfected.

NEWRY.

Members of the board: F. C. Kilgore, Secretary; C. H. L. Powers, Chairman; H. M. Kendall.

We have had twenty cases of scarlet fever; no deaths. Only two of the cases were reported by the physician. The first case was in a mild form and the disease was not recognized until several children were infected.

NEW SHARON.

Members of the board: D. R. Hargraves, Secretary; Chas. E. Gordon, Chairman; David J. Jordan.

There have been four cases of typhoid fever one of which was fatal. The cases were in no way connected, one case only occurring in a family, the shortest distance between any two cases being more than a mile. The cases were traceable to no particular cause, except perhaps in one case where the well was too near the outbuildings. One case of glanders was reported. The horse was killed. One cow was reported sick with dangerous symptoms, and

was visited by the Secretary who ordered it to be isolated and reported the case to the State Veterinarian. The cow died, undoubtedly of lung fever.

NEW SWEDEN.

Members of the board: Erik M. Lundvall, Secretary; O. P. Fogelin, Chairman; John Jacobson.

We have had no cases of the infectious diseases during the year. Before the summer term of the schools began we arranged a public vaccination, because most of the children under twelve years of age had never been vaccinated. We have also translated the public notices into the language that is used among our people here so that every person might be able to understand them.

NEW VINEYARD.

Members of the board: Geo. H. Pratt, Secretary; M. V. B. Hardy, Chairman; Oliver Waugh.

Four nuisances were reported to the board and all were promptly removed. We have had no contagious diseases excepting mumps. Pneumonia was also prevalent. Disease entered the herd of Warren Cooke, which caused the death of three of the cattle and the loss of sight of another. Veterinary-Surgeon Bailey of Portland was called and a post mortem examination was made, and the disease was decided to be acute pneumonia and that there was no infection in the herd, although he was puzzled in regard to the loss of sight of one of the animals, the symptoms of which had been identical with the fatal cases.

NOBLEBORO.

Members of the board: John M. Winslow, Secretary; Jas. Mulligan, Chairman; Wm. H. Moody.

One case of diphtheria and one of typhoid fever. In the case of diphtheria the house was placarded and isolation ordered, and in the typhoid fever case we furnished the family with the circular pertaining to that disease.

NORTH HAVEN.

Members of the board: B. C. Calderwood, Secretary: A. G. Beverage, Chairman; O. B. Kent.

We have had two cases of diphtheria, in both of which the patients recovered.

NORTHPORT.

Members of the board: M. C. Hill, Secretary; F. A. Rhoades, Chairman; J. R. Hurd.

One nuisance was reported and removed immediately. One non-fatal case of typhoid fever occurred. In the case of typhoid fever the family were at once supplied with the necessary directions issued by you. Carbolic acid and chloride of lime were used as disinfectants with perfect success. The case was a severe one in a family of seven, but no contagion resulted. This case of typhoid fever was imported. We are all ready to act promptly when there is anything to do.

NORTH YARMOUTH.

Members of the board: I. S. Stanwood, Secretary; Noah Jewett, Chairman; Wm. Osgood, M. D., Health Officer.

Two cases of scarlet fever were reported.

NORWAY.

Members of the board: E. F. Smith, Esq., Secretary; H. E. Mixer, Chairman; B. F. Bradbury, M. D.

We have had two fatal cases of typhoid fever. The work of the year has consisted in improving the general sanitary condition of the village in every way possible. Vaults have been much better cleaned out and cared for, less rubbish has been left to rot in by places and by care and tact the board has been able to have householders give much more attention to the conditions of their buildings and their immediate surroundings. In short the establishment of a board of health has for this town proved a great good.

A system of drainage and sewerage is much needed and must eventually be constructed. This would greatly improve the sanitary condition of the village.

OAKLAND.

Members of the board: H. W. Wells, Secretary; Geo. W. Hubbard, Chairman; W. Scott Holmes, M. D., Health Officer.

Three nuisances have been reported and removed. We have had five cases of scarlet fever and one of typhoid fever. The case of

typhoid fever originated on the premises by the use of water which was polluted by the sink spout and stagnant water. The case was attended to promptly and disinfectants were used. The patient recovered.

Old Orchard.

Members of the board: Wesley G. Smith, Secretary; Gilbert Wiley, Chairman; Jas. H. Ricker.

In the way of infectious diseases we had only one case of scarlet fever in a child brought from an infected locality in Massachusetts.

Old Orchard now has an extensive system of water works supplying water from Old Indian Spring, one-half mile from any dwelling house. We now have an annual appropriation for sanitary purposes and employ a team during the summer months to collect the swill, and also employ a laborer to keep the streets in the most thickly settled parts of the town free from waste paper, and all decaying matter. Our cottagers are giving more attention to sanitary measures, the result of which is that but a very little sickness occurs.

Oldtown.

Members of the board: A. Rigby, Secretary; C. P. Baker, Chairman; John Buffum.

Thirty cases of nuisance were reported, twenty-eight of which were abated. The citizens have responded very satisfactorily to the requests of the health officer.

We have had seven cases of typhoid fever. The physicians do not report cases of the infectious diseases.

Many low places have been cleaned out and the refuse has been hauled upon farms and worked into the soil. At the village of West Greatworks there is no proper drainage, and no place in town needs improvements more. Changes are now under consideration. The canal of stagnant water which ran through Upper Stillwater has been thoroughly drained, leaving but a small brook of clear water.

Orient.

Members of the board: Wm. McAllister, Secretary; Jas. Estabrook, Chairman; Joel Faulkner.

Two nuisances have been removed. We have had no cases of the infectious diseases.

ORLAND.

Members of the board: R. P. Harriman, Secretary; Frank P. Perry, Chairman; Henry Partridge.

We have had five cases of non-fatal typhoid fever.

ORNEVILLE.

Members of the board: A. C. Cushman, Secretary; F. W. Canney, Chairman; M. W. Morgan.

There have been two cases of typhoid fever.

ORONO.

Members of the board: C. P. Crowell, Secretary; J. H. Knox, Chairman and Health Officer; U. R. Penney.

Five nuisances have come to the attention of the board, all of which have been removed. There have been three cases of diphtheria and four of typhoid fever, all of which recovered. Some places in the town are rendered unhealthful by reason of lack of drainage and presence of slaughter houses. The sanitary condition of some of the school houses needs improving.

ORRINGTON.

Members of the board: Geo. B. Tibbetts, M. D., Secretary; A. N. Lufkin, Chairman; Chas. M. Rogers.

We have had no cases of the specified infectious diseases excepting five of typhoid fever, and one other case which came to my knowledge, but was not reported by the attending physician.

OTIS.

Members of the board: J. R. Grant, Secretary and Health Officer; W. W. Tibbetts, Chairman; L. W. Fogg.

Three cases of diphtheria occurred, one of which was fatal.

OTISFIELD.

Members of the board: F. J. Sawyer, Secretary; Sumner Spurr, Chairman; D. L. Brett.

There have been no cases of the contagious diseases in town, excepting three cases of diphtheria, all of which ended in recovery, and a run of mumps which we are having now.

OXFORD.

Members of the board: E. V. Walker, Secretary; S. P. Stewart, Chairman; Dr. Orrin Stevens.

Thirteen nuisances were reported to the board and were removed. For infectious diseases we have had only four cases of typhoid fever, and a prevalence of mumps. Some sanitary improvements are contemplated as early in the spring as the weather will permit.

PALMYRA.

Members of the board: Lewis Wyman, Secretary; G. W. Hanson, Chairman; J. B. Chase.

There has been one case of diphtheria. The infected house was placarded, the infected family and their neighbors were supplied with the diphtheria circulars and the teacher of the school then in session was notified and instructed as to her duty under the law.

PARKMAN.

Members of the board: J. C. Butterfield, M. D., Secretary and Health Officer; I. Briggs, Chairman; Charles Morrill.

We have had five cases of diphtheria, all recovering. Isolation and thorough disinfection were carried out.

PATTEN.

Members of the board: F. F. Bigelow, M. D., Secretary; Leroy Miles, Chairman; B. C. Woodbury, M. D.

One case of typhoid fever occurred and whooping-cough and measles have been prevalent.

PEMBROKE.

Members of the board: Wm. E. Leighton, Secretary; J. C. Rogers, M. D., Chairman; C. W. Hersey.

One complaint was received that a wool pulling establishment located on a stream, running through a portion of the west village. There was one case of diphtheria which we had isolated, the house placarded and disinfectants used.

PENOBSCOT.

Members of the board: E. A. Sprague, M. D., Secretary and Health Officer; John Snowman, Chairman; John Littlefield.

We had an outbreak of scarlet fever in which five cases occurred, one of which was fatal; measles have also been prevalent. Scarlet fever was more easily kept under control by the board than was the outbreak of measles, a state of things arising from the views which people take of the two diseases. The measles caused more deaths and impaired more constitutions than scarlet fever. I think that there is a useful lesson in the above facts.

Perkins.

Members of the board: G. W. Call, Secretary; T. G. White, Chairman; T. Hinckley.

Some work has been done in seeing to wells and privies, but no cases of the infectious diseases have occurred.

Perry.

Members of the board: G. P. Ricker, Secretary; J. B. Nutt, Chairman; Mark Leighton.

We have had no cases of the infectious diseases. There have usually been a few cases of diphtheria, but there have been none this year.

Peru.

Members of the board: A. B. Walker, Secretary; Otis Wyman, Chairman; A. E. Eastman.

I am glad to be able to report that we have had no case of the contagious diseases of the past year.

Pittsfield.

Members of the board: T. Griffin, M. D., Secretary; H. C. Pooler, Chairman; D. M. Parke.

The sewers in the village have been extended and more waste pipes have been run into the old sewers. Five nuisances were reported, two of which were removed, one partially corrected, and two remain owing to the expense of removal. Twelve cases of diphtheria occurred, none of which were fatal, and there were eight cases of typhoid fever, with one death. Typhoid fever broke out in a boarding house where it appeared the year before.

PITTSTON.

Members of the board: J. W. Jewett, Secretary; E. A. Lapham, Chairman; C. C. Libby, M. D., Health Officer.

No cases of the infectious diseases have occurred.

PLYMOUTH.

Members of the board: L. A. Cook, Secretary; John Longly, Chairman; S. P. Gifford.

We had one case of diphtheria which ended in recovery, and tonsilitis and measles have been prevalent.

POLAND.

Members of the board: Walter Corliss, M. D., Secretary; B. M. Fernald, Chairman; S. L. Littlefield.

Four nuisances were reported, all of which were removed. Five cases of scarlet fever and two of typhoid fever have occurred with one death from the latter disease. Our school houses have not received the amount of care that they should have had.

PORTER.

Members of the board: Warren Libby, Secretary; John B. Danforth, Chairman; Dan'l B. Ridlon.

One case of typhoid fever occurred. Continued fevers were quite prevalent and an epidemic resembling pneumonia in a mild form occurred. The village of Kezar Falls partly in this town and partly in Parsonsfield is in an unhealthful condition, due in the opinion of our board, to polluted water and want of proper sewerage.

PORTLAND.

Members of the board: Geo. C. Burgess, 55 Atlantic St., Secretary and Executive Officer; Charles D. Smith, M. D., 126 Free St., Chairman; A. K. P. Meserve, M. D., 109 Emery St.

Thirty-one meetings have been held during the year.

No changes have been made in the water supply. The improvements made are additional pressure for the better supply of the eastern end of the city, and the construction of an additional reservoir of 20,000,000 gallons' capacity (not yet completed), in the same section.

Seven thousand four hundred sixty-three and five-tenths lineal feet of street sewers have been built during the year. Since May

last, all privy vaults have been cleaned out in the daytime, with a result which greatly surprises us. No more foul odors during the night, when open windows are a necessity, nor passing of heavy wagons with all their accompanying and attendant evils.

Air tight oak barrels, whose iron heads are clamped down upon a rubber gasket, are used to remove the excreta. Crude carbolic acid, or a disinfecting preparation called "Elatol," is used to deodorize the vaults before beginning work, during its progess, and at its close. The work must be done in the daytime behind a movable screen, at hours which will not interfere with the meal times of a family. Although our rules allow this work to be done in the night on written application of a householder, none have been made during the eight months in which this system has been in operation. As the barrels are kept clean outside, a load of them passes through the streets entirely inoffensive to the passers-by. We call the method a great success.

709 formal complaints of nuisances existing have been made to the board; all, with one exception, have been removed or alleviated as the circumstances of the case would admit. The one case spoken of has not been entirely removed, solely because the ownership of the property could not be determined. The original owner was absent at sea, not to be heard from, property under two mortgages, tenants more or less squatters, or not paying rent. The property is now sold, and we hope to see an improved state of things.

Report of Health Inspector.

No. of formal complaints	709
vaults found in bad condition	1001
overflowing vaults	19
" cess-pools	26
cellars in bad condition	256
water-closets inspected	483
found fairly good, 389; bad, 94	
removed swine	19
water-closets ordered built, privies removed	147
sinks found without traps	258
bad sink drains ordered repaired	592
visits on account of contagious diseases	220
visits not classified, but mostly to see that previous orders of the board had been complied with	1351

The greatest difficulty which we experience in our work, is the absence of authority to compel good plumbing and good house drainage. We cannot speak in terms too strong in reprobation of landlords or plumbers who will allow such positively dangerous work to be set up as we occasionally find.

Some of our surface drainage problems also are hard to solve, as where the wash of a stable runs across the yard of a neighbor whose land lies lower, but these are few. The two cases of open defiance of the orders of the board were settled on the "unconditional surrender" of the parties before their cases reached the courts.

CONTAGIOUS DISEASES.

Small-pox (Varioloid), 2 cases; diphtheria, 63 cases, 16 deaths; scarlet fever, 35 cases, 2 deaths; typhoid fever, 28 cases, 6 deaths.

So far as we know the physicians comply with the law requiring reports of contagious diseases. By comparison with our report of last year you will see that all classes of contagious diseases on which we report are less this year than last. Diphtheria, 63 cases against 128; scarlet fever, 35 against 64; typhoid fever, 28 against 80.

When cases of contagious disease are reported we report the case to the Supt. of Schools, card the house, furnish the family with circulars, and let the attending physician take responsibility of the case.

It is difficult to say what localities are unhealthy. Some of our worst cases of disease have occurred where we least expected them. And some of our worst localities are as yet almost unvisited by zymotic diseases, but we do not any the less relax our efforts to keep such places cleaned up. Our house to house inspections have wrought good effects in such localities.

For improving our sanitary conditions, the only method we have to suggest, is work, work, work! on the same lines we now follow.

No kerosene accidents have occurred to our knowledge from which sickness or death have resulted. Deaths have resulted from the following accidents:

Unclassified 3. Scalded 2. Falls 5. Drowned 3. Murder, Adult 1, Infanticide 1. Perforation of œsophagus 1. Suicide 3. Railroad 3. Crushed by falling iron 1.

The above we think includes nearly the whole outline of our work for the year.

The general plan upon which we work is not only to attend to the daily complaints received, but to improve the sanitary condition of those sections of the city most needing it. To this end we make our house to house inspections, giving advice with regard to improvements needed, keep particular watch of the largest and worst tenement houses, circulate the publications of the State Board of Health, and in every and all cases endeavor to convince even the hardest cases that we are not fighting them but aiding them.

Pownal.

Members of the board: S. A. Vosmus, M. D., Secretary; Moses Plummer, Esq., Chairman; I. S. Brown.

Three cases of diphtheria with one death occurred. The infected houses were placarded and isolation was carried out. Many of our school-houses are in a bad condition.

Prentiss.

Members of the board: Thos. Butterfield, Secretary; E. E. Butters, Chairman; J. F. Belden.

We have had no infectious disease, excepting whooping cough.

Pre-que Isle.

Members of the board: F. Kilburn, M. D., Secretary; C. P. Allen, Esq., Chairman; G. H. Freeman, M. D.

We have had two cases of scarlet fever and ten cases of typhoid fever, with two deaths from the latter disease. Measles and whooping-cough have been quite prevalent, and during the autumn and early winter catarrhal jaundice was very prevalent. There must have been several hundred cases in this county judging from the number in this town. There were four cases of cerebro-spinal meningitis, all fatal. The typhoid fever outbreak which was reported last April assumed a typical form. The period of incubation was short and the disease continued only from eight to twelve days, excepting in one case where there were two relapses. The two fatal cases terminated early in the second week. I saw a number of similar cases at Ashland during the summer. Many of them terminated with a crisis on the eighth or tenth days. There was another epidemic in Chapman Plantation where one physician reported forty cases of "slow fever." I did not see any of them.

One case of glanders occurred in a horse which was seen by Dr. Bailey and destroyed.

PRINCETON.

Members of the board: S. G. Spooner, M. D., Secretary; C. Flower, M. D., Chairman; Jas. Spencer.

Measles and whooping-cough have been quite prevalent, and the schools were closed on their account. Typhoid fever has been very prevalent, and including both mild and severe cases there have probably been fifty cases, with only one death.

PROSPECT.

Members of the board: J. H. Littlefield, Secretary; Capt. G. W. Dow, Chairman; Capt. Robert Killman.

We have had but little to do until the appearance of the recent cases of diphtheria which have been reported to your office (Feb. 1889.) We think our town is a very healthful one and the people in general are awake to the importance of restricting the spread of contagious diseases. I think the circulars and especially the Sanitary Inspector sent from your office are doing a good work, and one appreciated by our people.

RANDOLPH.

Members of the board: B. A. Cox, Secretary; Albert White, Chairman; Benj. Clark.

We have had one case of diphtheria, and five of typhoid fever. All cases of infectious diseases that have been reported to us have been attended to at once. Three complaints of nuisances of minor character have been received, and abatement was secured in each case. We have inspected a number of places which we feared might cause sickness, and improvements have been made at once in accordance with our suggestions.

RAYMOND.

Members of the board: L. H. Jordan, M. D., Secretary; Alfred Wilson, Chairman; R. S. Smith.

We have had eleven (?) cases of diphtheria with one death and one case of typhoid fever ending in recovery. In one case of diphtheria the child had about three weeks before the attack visited in Portland and slept in a room where several months before a child had been very sick with diphtheria.

Readfield.

Members of the board: W. A. Wright, M. D., Secretary; Prof. W. C. Strong, Chairman; E. S. Hanaford, M. D.

Two nuisances were removed. We have had no infectious diseases, excepting German measles and mumps. Erysipelas and rheumatism have been quite prevalent, due perhaps to the damp and changeable weather.

Ripley.

Members of the board: A. G. Farrar, Secretary; A. R. Dunlap, Chairman; E. H. Ramsdell.

Three nuisances have been removed without much trouble. We have had no cases of the infectious diseases. I think theie is a great improvement in regard to the causes of contagious diseases since the establishment of the board of health, inasmuch as the people are more careful to look after places that cause such diseases.

Robbinston.

Members of the board: F. R. Leach, Secretary; S. H. Gates, Chairman; N. E. Campbell; J. E. Brown, M. D., Health Officer.

We have had two cases of diphtheria, with one death. The secretary also encloses the report of the special health officer, Dr. Brown of Calais, who was employed by the board to supervise the disinfection of houses where diphtheria had occurred. It shows that careful work was done. At one place an excelsior mattress and some other things of little value, but which would be difficult of disinfection, were burned and the health officer made the very just recommendation that indemnity be made in the sum of $3.75 to the owner of the articles which were destroyed.

Rockland.

Members of the board: F. E. Hitchcock, M. D., Secretary; O. H. Tripp, Chairman; C. E. Littlefield, Esq.

The city of Rockland has two sources of water supply. One, the older system, is taken from Chickawaukee Pond. The source of supply is situated two and one-half miles to the northwest, is at an elevation of eighty-four feet, with a storage reservoir about seventy feet above the city level. The water is very pure and is removed from danger of pollution. Our second source of

supply is Oyster River Pond, situated about seven miles from the city, in same direction, and is separated from any danger of pollution; is three hundred and thirty feet above the sea level, and that of the city. The reservoir, of large capacity, is situated at Juniper Hill, immediately above the city, at an elevation of two hundred and fifty feet. The latter system is generally used by the citizens and by the city. It also supplies Thomaston and the State Prison, Camden, Rockport, and will be introduced into the Bay Point hotel and the adjacent cottages. (See report of analyses on page 51.)

There has been a marked advance in regard to drainage and sewerage. The board of health employed E. C. Jordan, C. E., of the State Board of Health, to officially visit the city, and pursuant to his suggestions the need of a sewerage survey became apparent, and has been made by C. E. Danforth of Gardiner, Maine. The city can now look forward to intelligent and simplified sewerage.

There is a pressing need of a better method of garbage disposal. The board obtained the refusal of an unused lime kiln, with the idea of making a garbage furnace, but for want of support the plan has not been carried out. There exists no authorized dump or other place for the disposal of garbage.

Fifty-eight complaints of nuisances have been attended to. There has been no marked difficulty in their abatement. All resistance to the authority of the board of health has subsided after a careful explanation has been given and the law has been explained.

We have had twenty cases of diphtheria with five deaths, three of scarlet fever with one death, and six of typhoid fever, all ending in recovery. Typhoid fever is always imported when it appears, is not indigenous and cannot be, on account of the favorable character of our water supply.

When cases of the infectious diseases have appeared the schools have been notified, the houses placarded, and after the subsidence of the disease, the rooms are washed with a disinfecting solution, walls are re-papered, ceilings whitewashed and clothing and furniture disinfected, boiled or destroyed.

Two cases of accidental drowning and two fatal cases of burning from kindling fires with kerosene have occurred.

Rome.

Members of the board: L. G. Martin, Secretary; G. S. Tibbetts, Chairman; E. T. Foster.

We have had five cases of typhoid fever, none of which terminated fatally. We supplied the circulars sent by the State Board and their recommendations were cheerfully carried out.

ROXBURY.

Members of the board: A. W. Robbins, Secretary; S. M. Locke, Chairman; W. H. Jenne.

We have had no cases of the infectious diseases.

SALEM.

Members of the board: Geo. W. Harris, Secretary; N. P. Harris, Chairman; F. R. Hodgman.

One nuisance was reported and removed. We have had fourteen cases of diphtheria, resulting in five deaths. The board has taken charge of all cases of infectious diseases, and used all and every means to prevent the spreading of them.

We know that all the lard and nearly all the spices on the market are adulterated to a greater or less extent, and we doubt that a strictly pure article could be purchased to-day of any dealer in our country.

SANFORD.

Members of the board: Geo. E. Allen, Esq. Secretary; A. B. Sanborn, Chairman; E. J. Hatch.

We have had fifteen cases of diphtheria resulting in six deaths, seven of scarlet fever, all ending in recovery, and six of typhoid fever, two of which proved fatal. Infected houses have been placarded and intercourse as far as possible forbidden with everybody except the physician.

In Sanford village there is one locality where typhoid fever has prevailed, due, I think, to impure well water. Next season the Sanford Water Company will extend their system to that part of the village; then I expect a decided improvement.

SANGERVILLE.

Members of the board: H. L. Leland, Secretary; A. T. Wade, Chairman; O. B. Williams; Austin Thomas, M. D., Health Officer.

There have been no cases of the infectious diseases, excepting measles.

SCARBORO.

Members of the board: J. B. Thornton, M. D., Secretary; B. F. Carter, Chairman; M. I. Milliken.

One nuisance was removed by the board. We had four cases of diphtheria, two of which ended fatally, and three cases of typhoid fever with one death. In connection with cases of the infectious diseases the prescribed course of isolation, disinfection, and sanitation is actively carried out. For improving the sanitary condition of our town I would suggest an attempt to educate its people as regards the laws of health,—cleanliness, proper food rightly cooked, healthful dress, proper arrangement of buildings, wells, outhouses, increased air space in sleeping rooms, "cussedness of quack medicines," etc.

SEARSMONT.

Members of the board: J. W. Farrar, Secretary; P. S. Wing, Chairman; J. E. Woodcock.

The hotel and one private house has been supplied with water from a spring. One nuisance was corrected by the board. No cases of infectious diseases have been reported to the board. Our physicians are in full sympathy with our work and would report if there were any cases.

SEARSPORT.

Members of the board: E. Hopkins, M. D., Secretary; W. O. Barney, Chairman; W. B. Sawyer.

We have begun a plan of sewerage and drainage for the village. One nuisance was removed by the board. We have had no cases of the infectious diseases.

SEBAGO.

Members of the board: P. P. Larrabee, Secretary; P. W. Sawyer, Chairman; B. F. Cole.

No cases of contagious diseases have called for action from the board.

SEDGWICK.

Members of the board: M. L. Elwell, Esq., Secretary; R. E. Hagerthy, M. D., Chairman; J. W. Penney.

We have had three cases of typhoid fever resulting in one death.

Shapleigh.

Members of the board: F. A. Bragdon, M. D., Secretary; John Pugsley, Chairman; L. W. Leighton, M. D.

We have had two cases of typhoid fever, one of which ended fatally. The sanitary condition of our town is very good.

Sherman.

Members of the board: L. C. Caldwell, Esq., Secretary; Geo. W. Durgin, Chairman; D. H. Owen, M. D.

We have had five cases of diphtheria with two deaths. Our method has been immediately to isolate the patient from the rest of the family, placard the house, isolate the family or all that have been exposed to infection until we are notified by the attending physician that restrictions are no longer necessary, and have a thorough cleansing and disinfection of clothing, house and out-door premises carried out. When the afflicted family is not able to do so we engage nurses and have the cooking of the food for the family done away from the infected premises.

The board has personally examined quite a large number of places in the town the past year where they suspected the sanitary condition was not good, and where it was thought necessary, suggested changes, such as the cleansing of water supplies, more thorough drainage around dwellings, and removal and safe disposal of excreta.

We also instructed all the school agents to examine the premises around the school-houses, to thoroughly cleanse the privies, and examine the water, and to see that good pure water was supplied.

We have also suggested to the proprietors of the starch factory a more thorough drainage, and safe disposal of the potato pumice, as recommended by the Secretary of the State Board of Health, at the time of his visit here last fall, which the owners promised to do next summer.

Since the establishment of the local board of health I think a marked improvement is discernible in the sanitary condition of the town. Many of the citizens have voluntarily improved the condition of their premises in a sanitary point of view and the inhabitants generally have cheerfully co-operated with the board in carrying out suggestions made by the board.

SHIRLEY.

Members of the board: Henry Blackstone, Esq., Secretary; A. T. Mitchell, Chairman; Jos. Dennen.

We have had no cases of the infectious diseases.

SKOWHEGAN.

Members of the board: Geo. Cushing, Secretary; S. A. Patten, M. D., Chairman; S. A. Bickford.

A system of water supply has been introduced into the village, and a system of sewerage is being put in. Several nuisances have been reported and have been removed as far as possible. There have been seven cases of typhoid fever, resulting in one death.

SMITHFIELD.

Members of the board: Wm. J. Haynes, Secretary; I. W. Varney, Chairman; Chas. M. Simmonds.

I am happy to say that no contagious diseases whatever have infested the town during the past year. There have been but few deaths in town, only three which I can call to mind at the present time.

SOUTH BERWICK.

Members of the board: Edwin Jacques, Secretary; Wm. A. Parsons, Chairman; C. M. Sleeper.

About a dozen nuisances have been reported during the year, and at the suggestion of the board all but one have been promptly abated. One was taken in hand by the board and the expenses were collected from the owner. There have been eight cases of diphtheria reported to the board, two of which ended fatally; ten cases of typhoid fever with two deaths. In cases of infectious diseases the local board has endeavored faithfully to carry out the suggestions of the State Board by complete isolation and thorough disinfection.

A complete inspection of the entire village was made by the board in the early summer and frequent suggestions were made which were generally kindly received and acted upon. The board is getting a better understanding of its duties and the community is beginning to estimate fairly the value of the health laws of the past few years, and there seems a general readiness to comply with the wishes of the local board.

Southport.

Members of the board: Sumner Orne, Secretary; Wm. T. Maddocks, Chairman; Stephen Pierce.

We have had one fatal case of typhoid fever.

South Thomaston.

Members of the board: Fred J. Dow, Secretary; Wm. H. Luce, Chairman; John Alexander.

There have been no cases of the infectious diseases reported to the board, and but one nuisance which was promptly removed.

Springfield.

Members of the board: P. H. Jones, M. D., Secretary; E. C. Ryder, Esq., Chairman; C. R. Brown.

There have been about twenty-eight cases of diphtheria, causing four deaths, and we have had two cases of non-fatal typhoid fever. Measles was prevalent in the spring. We have prohibited public funerals where death was caused by diphtheria and have advised thorough disinfection of house and clothing.

St. Albans.

Members of the board: C. A. Moulton, M. D., Secretary; S. A. Maxim, Chairman; N. H. Vining.

We have had one case of diphtheria and four cases of typhoid fever, all terminating in recovery. One family had a diarrhœal disease of a typhoid form affecting all the members in the family. The water was suspected of being polluted and an investigation by the board showed that the well was so situated that it received the washings from the stable and yard undoubtedly causing the disease.

Standish.

Members of the board: C. F. Swasey, Secretary; Dan'l L. Warren, Chairman; C. D. W. Shaw.

There have been six cases of typhoid fever with one death from that disease. During the early part of the winter typhoid fever prevailed in the northern section of the town. The cause was undoubtedly bad well water. Upon the advice of our secretary the well was closed and it has not been used since.

STARKS.

Members of the board: Thos. Buswell, Secretary; Jacob F. Frederic, Chairman; Leander F. Butler.

We have had one case of diphtheria and one fatal case of typhoid fever. The diphtheria patient contracted the disease at the Insane Hospital. She was isolated and supplied with nurses in an unoccupied house and when the attending physician reported all danger passed she was furnished with a change of clothes and was allowed to go home. The house was thoroughly cleansed and no cases have occurred since. Then an outbreak of measles occurred. The case of typhoid fever was probably caused by impure water, the well being close to the barnyard. A new well has since been dug in another place.

STETSON.

Members of the board: E. W. Perry, M. D., Secretary; Geo. M. Bond, Esq., Chairman; Rev. H. S. Morton.

Two nuisances were reported and promptly removed upon notification. We had two cases of typhoid fever; the head of the family was furnished with printed instructions that were sent out by the State Board of Health, and an explanation was given as to the causes or probable causes of the fever, and proper disinfection was assured. All contagious matter was buried.

The school house in the village is in a shameful and neglected condition and looks as if a lot of pigs or sheep occupied it.

In my opinion all the typhoid fever cases which we have had here have been due to the poor drainage of a part of the village which is flat and wet and where the sewer or drain leading from it is so flat that the water is nearly or quite stagnant, and to make it worse this drain receives the sewage from barns and houses.

One of the typhoid fever cases came from Turner to bury a sister. She drank the water from a well which supplied the house and in three weeks came down with fever in a severe form. The other case of fever reported drank water from a well which is situated about twenty-five feet from stagnant marsh ground spoken of above, and is also by the side of a house where all the slops are thrown upon the ground from a window.

STEUBEN.

Members of the board: James C. Googins, Secretary; G. W. Moore, Chairman; Samuel Parritt.

One case of diphtheria occurred, ending in recovery.

ST. GEORGE.

Members of the board: A. Woodside, M. D., Secretary; Whitney Long, Chairman; H. H. Kalloch.

One nuisance was reported and removed. There was one case of diphtheria, two of scarlet fever, and three of typhoid fever, all ending in recovery. Infected houses have been placarded and patients have been isolated. The sanitary condition of some of our school houses might be much improved. Two accidental deaths from fire.

STOCKTON.

Members of the board: C. S. Rendell, Secretary; J. F. Hichborn, Chairman; J. W. Thompson, Health Officer.

Before the organization of the board a case of scarlet fever was reported May 16. The patient died. Precautions were taken, but on June 4th two more cases were reported which proved to be mild. The same precautions were taken and no more cases in town have come to the knowledge of the board. One case of typhoid fever occurred.

STOW.

Members of the board: I. A. Walker, Secretary; C. K. Bickford, Chairman; O. P. Charles.

We had two cases of typhoid fever, one of which ended fatally. It is thonght the fever was contracted at Conway, N. H.

STRONG.

Members of the board: A. Hitchcock, M. D., Secretary; Hon. J. W. Porter, Chairman; G. Z. Higgins, M. D.

One case of diphtheria has occurred.

SULLIVAN.

Members of the board: F. W. Bridgham, M. D., Secretary and Health Officer; M. H. Hawkins, Chairman; M. E. Rideout.

This has been an unusually healthy year with us. No contagious disease is prevailing except a few cases of the German measles. Several accidents have occurred in the quarries from premature blast explosions; one death by drowning. Epidemic catarrh (pink-eye) prevailed among horses pretty extensively. A few persons were affected with sore eyes about the same time, but the trouble was not general.

The only unhealthful places about town are about the quarries where the inhabitants of the shanties have no privies and slops are thrown on the ground under the windows.

Sumner.

Members of the board: C. M. Bisbee, M. D., Secretary; S. Robinson, Chairman; L. L. Gardiner.

We have had two cases of typhoid fever, and these were well looked after. One of the cases seemed to arise from polluted water. L. H. Maxim of this town lost five or six calves from what seemed like congestion of lungs and pleura. It was thought to have been caused from eating linseed meal.

Surry.

Members of the board: W. E. Emery, M. D., Secretary; D. G. Means, Esq., Chairman; Jas. A. Milliken.

Six non-fatal cases of typhoid fever occurred. There are no places in town which are naturally unhealthful, but there are a few premises in town which are unhealthful on account of the filthiness and laziness of their inhabitants. The following is an example: I was called to investigate the origin of the death of a little child which the neighbors said died of some disease they never saw before. (They called no physician to the child for they said the child died in a very short time after it was taken, not giving them time.) Upon investigation I found decayed vegetables and rotten wood in the cellar (which was also damp) which had probably been there for some few years not having been cleaned out. Every room in the house was black with smoke. The plastering was coming off and hanging in places; every floor in the house was covered with mud and dirt. Upon the shelves of an open cupboard which was exposed to the foul atmosphere of the rooms were placed the food and milk. Upon one shelf was a pan of meat so old that it smelled

badly, and was covered with the white film seen on frosty mornings. In close proximity to this was one pan of milk and some bread in a plate. The bread was black and mouldy and very hard. Upon looking at the only remaining child, her face was terribly dirty, also the mother's. Upon questioning her about the symptoms of the disease of which her little one had died, she said it was taken somewhat pressed for breath, glands soon began to be enlarged and could not swallow, seemed to suffer some pain, and bowels were quite loose. It seems to me the child died from septic poison.

SWANVILLE.

Members of the board: Dr. E. W. Gould, Secretary; Henry Greeley, Chairman; C. M. Marden.

One nuisance was reported and was promptly removed without trouble. Typhoid fever was imported from North Jay and resulted in five cases of a mild form. The excreta was ordered disinfected and buried away from the buildings.

SWEDEN.

Members of the board: Geo. Haskell, Secretary; E. F. Bangs, Chairman; O. R. Maxwell.

We had one case of typhoid fever ending in recovery. This case occurred in the same family as the five cases reported last year. There were also five cases of measles.

TALMAGE.

Members of the board: F. R. Neal, Secretary; Henry Dunsmoor, Chairman; Geo. Williams.

The town is thinly settled with farmers using pure spring or well water. We have had no cases of contagious diseases.

TEMPLE.

Members of the board: L. N. F. Jenkins, Secretary; Silas Wilder, Chairman; Rev. O. Roys.

We have had no cases of infectious diseases. One nuisance was removed.

THOMASTON.

Members of the board: H. C. Levensaler, M. D., Secretary; J. H. H. Hewett, Chairman; J. E. Walker, M. D.

Our water supply, the source of which is Oyster River Pond, is of excellent quality. Several nuisances have been reported and in most instances the requirements of the board have been complied with.

One case of diphtheria and three of typhoid fever occurred. All recovered. The law concerning contagious diseases has been enforced and the directions of the State Board have been carried out. The sanitary arrangements about our school buildings are defective. The ventilation is bad.

We have no particularly unhealthful locality. It is generally some particularly located dwelling that is unhealthful, but we think that the people are becoming more careful in regard to sanitary regulations and are keeping their premises in a more cleanly condition, having had their attention directed towards hygienic rules, and the facts that their observance is the road which leads to the prevention of disease and the preservation of health. They are fast being educated in this direction by the action of State and local boards of health, and are mindful of the importance of those instructions. A system of sewerage is needed very much.

One terrible accident occurred from the explosion of a slug of dualine which had been left in a quarry and which some little boys dropped into a partially drilled hole in the lime rock. Several other accidents occurred, one of which was the fracture of both legs, both thighs and one arm in a boy of eleven years of age whose clothing became caught in the overshot wheel at the grist mill.

Topsfield.

Members of the board: E. Tupper, Secretary; Wm. H. Malkson, Chairman; G. S. S. White.

We have had no cases of infectious diseases.

Topsham.

Members of the board: E. M. Brown, Secretary; I. S. Curtis, M. D., Chairman; David Work.

Five nuisances have been reported, four of which were removed. We have had one fatal case of diphtheria and thirteen cases of typhoid fever which ended in recovery.

Cases of the infectious diseases received immediate attention when reported. We need a system of sewerage.

TREMONT.

Members of the board: Wm. A. Spear, M. D., Secretary; Jas. T. Clark, Chairman; John H. Gilley.

There has been one case of scarlet fever which was promptly isolated and premises and clothing were thoroughly disinfected. No deaths have occurred from accidents except one probably from building a fire with kerosene, but as the victim was alone until too late to explain there can be no report given.

TRENTON.

Members of the board: K. K. Thompson, Secretary; Wm. G. Bunker, Chairman; D. B. Alley.

There have been no cases of the infectious diseases.

TRESCOTT.

Members of the board: John Sanders, Secretary; Wm. H. Leighton, Chairman; S. A. Wilcox.

We have had no cases of the infectious diseases. We have no villages and the town consists of about ninety farms and farm houses which are usually located some distance apart. The water supply comes mostly from springs, though a few wells are used. I think the water is good. The privies are not attached to the houses.

TROY.

Members of the board: M. T. Dodge, M. D., Secretary; John Woods, Chairman; Reuben Call.

No cases of infectious diseases have occurred. Prompt action would be taken if they should appear. Improvements might be made in the arrangements for water supply and in the care of privies.

TURNER.

Members of the board: S. D. Andrews, Secretary; Maj. H. C. Haskell, Chairman; J. H. Conant.

The town has been remarkably free from sickness, no cases of the infectious diseases occurring, excepting one case of diphtheria which recovered. Isolation, placarding the house, distribution of circulars and the notification of teachers was carried out.

I think the people are becoming better instructed in regard to drainage, sewerage and the disposal of excreta and are taking more care in these matters.

UNION.

Members of the board: E. R. Daniels, Secretary; A. P. Heald, M. D.; O. N. Butler.

We had two cases of typhoid fever, one of which was fatal. One case of poisoning from coal gas occurred, but the patient recovered.

UNITY.

Members of the board: Jas. Craig, M. D., Secretary; John Perley, Chairman; Benj. F. Kelly.

One case of diphtheria occurred in a pupil of one of the schools during a four days' vacation. This child and others from the same family were excluded from the school and were isolated.

UPTON.

Members of the board: C. L. Abbott, Secretary; Enoch Abbott, Chairman; W. F. Heminway.

There have been no cases of contagious diseases.

VANCEBORO.

Members of the board: C. A. Sterling, Secretary; W. R. Finson, Chairman; Geo. H. Peva; M. L. Young, M. D., Health Officer.

Fifteen complaints of nuisances have been made to the board. Eight were removed, six were without foundation, and in one case the board of health by repeated postponement of action neglected duty until nature removed the nuisance by evaporation. There has been one case of diphtheria and one of typhoid fever. Measles and mumps have visited the town. The work of the board has been in great measure suggestive rather than executive, the people more readily acquiescing with requirements as they are better understood.

VASSALBORO.

Members of the board: G. L. Randall, Secretary; M. K. Dwinell, M. D., Chairman; F. A. Libby, M. D.

We have had four cases of diphtheria, and I have known of two cases of typhoid fever, with no deaths from either disease.

VEAZIE.

Members of the board: L. H. Park, Secretary; O. D. Winchester, Chairman; J. B. Skinner.

Three or four nuisances were reported and the orders and suggestions of the board regarding them were cheerfully carried out. There have been no cases of the contagious diseases.

VERONA.

Members of the board: A. H. Whitmore, Secretary; Jos. Allen, Chairman; Peter Abbott.

There have been no cases of diphtheria, scarlet fever or typhoid fever, but we had about thirty cases of measles. The board investigated a case which came from Cumberland Mills, but it proved to be measles.

VIENNA.

Members of the board: L. C. Davis. Secretary; Ratio Porter, Chairman; Laforest Dowst.

One nuisance was reported which was removed. There have been no cases of the infectious diseases.

VINALHAVEN.

Members of the board: E. H. Lyford, M. D., Secretary; Wm. H. Littlefield, Chairman; J. B. Babbidge.

Two nuisances were reported, both of which were cheerfully abated. There were five cases of diphtheria with two deaths, six cases of scarlet fever, with one death, and one case of typhoid fever.

WAITE.

Members of the board: John Dudley, Esq., Secretary; C. B. Tupper, Chairman; J. B. Phelps.

We have had no cases of the contagious diseases.

WALDO.

Members of the board: Geo. C. Harding, Secretary; A. J. Simmons, Chairman; John D. Webster.

Three cases of diphtheria in a mild form occurred.

WALDOBORO.

Members of the board: F. M. Eveleth, M. D., Secretary; Chas. E. Hovey, Chairman; Everett Farrington.

We have had four cases of diphtheria, six of scarlet fever, and four of typhoid fever. Two of the typhoid patients died. Cases of the infectious diseases are not well reported; one case of typhoid fever was not reported by the attending physician until after the death of the patient. The excuse given was; "I did not know the patient's name." In one case the school was ordered closed on account of scarlet fever, but the case was not reported to the local board. Early in the season there were eighteen deaths of cows from puerperal apoplexy.

WALES.

Members of the board: Alden Moulton, Secretary; Jos. C. Bragg, Chairman; Benj. Hodsdon.

There have been no cases of the infectious diseases.

WALTHAM.

Members of the board: Aldin Haslam, Secretary; Wm. Fox, Chairman; David Ingalls.

One death occurred from typhoid fever.

WARREN.

Members of the board: J. M. Wakefield, Secretary; B. B. Libby, Chairman; W. O. Counce.

There have been ten cases of diphtheria, with one death, one case of scarlet fever, and two of typhoid fever. Two persons were nearly suffocated with coal gas. Two young men died from drinking tincture of aconite by mistake.

WASHBURN.

Members of the board: P. J. Conroy, M. D., Secretary; C. L. Stoddard, Chairman.

Complaints were made of two nuisances which were immediately removed. Measles and whooping cough have prevailed since early in the fall, but they do not trouble our schools much as we stop the families who have either of the diseases from sending scholars.

In one locality in our village typhoid fever has been very prevalent during the last eleven years. Seven cases occurred among the families living in this locality during the summer of 1888, and in 1887 there were about forty cases. At our request the Secretary of the State Board of Health visited the village and made an examination of the locality, and had samples of water from the wells sent for analysis (See page 60). Generally it is found necessary to dig from sixty to eighty feet for water, but in this typhoid fever locality the wells are from eleven to fourteen feet and are dug through gravel until the clay is reached and then the digging is stopped. Surface water only is thus obtained, and it is undoubtedly polluted by the privies which are usually not far distant from the wells. The probable reason for the smaller prevalence of typhoid fever in this locality as compared with the previous year is the fact that the past season was very cold and wet, and the water did not become so low in the wells.

WASHINGTON.

Members of the board: T. S. Bowden, Secretary; H. B. Wright, Chairman; F. O. Bartlett, M. D.

Only one nuisance has been reported to the board. Typhoid fever has been more prevalent than usual (the number of cases is not given). The school-house privies generally are a nuisance and filthy. Proper ventilation is also much needed. One boy, eleven years of age, was drowned by skating into a hole in the ice. One woman was severely poisoned by eating canned peaches, but recovered.

The local board of health of Washington have promptly reported infectious diseases to the State Board, placarded infectious houses, have abated all nuisances promptly which have been reported to it, and has made suggestions whenever deemed of good and has exercised a general regard for the health of the town.

WATERFORD.

Members of the board: C. L. Wilson, M. D., Secretary; C. M. Cooledge, M. D.; Melville Munroe.

One mild case of typhoid fever occurred.

WATERVILLE.

Members of the board: H. D. Bates, Secretary; M. H. Holmes, M. D., Chairman; J. H. Plaisted; F. C. Thayer, M. D., Health Officer.

The water supply is furnished by the Waterville Water Company and has been put in very generally by our citizens. The water is from Messalonskee stream and is claimed to be of excellent quality.

The city has spent $10,000 on sewerage, building of brick sewer 747 feet 27x36 inches, 503 feet 21x27 inches, and of pipe sewer 214 feet 15 inch, 1089 feet 20 inch. This work makes it possible to have drainage and sewerage for the west side of the business part of Main street, improves the drainage of Gilman bog and takes the water that formerly made a large stagnant place near the corner of Maine and Temple streets. The sewerage system will probably be extended further during the year 1889.

About twenty complaints of nuisances have been made to the board and all have been attended to by the parties complained of.

Of contagious diseases we have had one case of varioloid, six of diphtheria, ten of scarlet fever, and fourteen of typhoid fever. One of the typhoid fever cases ended fatally. One physician thinks that cases of contagious disease in a certain locality are caused by drink water from the Kennebec river.

WAYNE.

Members of the board: F. L. Cheney, M. D., Secretary; C. H. Barker, Jr.; W. Jennings.

Five cases of typhoid fever were reported to the board, one of which ended fatally. There has not been a case of typhoid fever in the village for twenty years until the spring of 1888, when one case occurred in March and another in early summer. The other cases were out of the village.

WEBSTER.

Members of the board: J. G. Jordan, Secretary; A. J. Larrabee, Chairman; T. C. Billings.

We have had two nuisances, but there was no difficulty in removing them. One case of scarlet fever occurred from picking over rags. The patient was isolated and the house was placarded. We need better drainage in the village and better ventilation in the school-houses.

WELD.

Members of the board: C. E. Proctor, M. D., Secretary; A. E. Houghton, Chairman; L. L. Jones.

One nuisance was removed. One case of typhoid fever occurred.

WELLINGTON.

Members of the board: Wm. Lawrence, Secretary; Reuben Whitehouse, Chairman; G. A. Harriman.

We had an outbreak of diphtheria in which there were twenty-two cases with seven deaths. We think this disease was brought into town by the visit of a lady from another town who had what the doctor in attendance called tonsilitis. She associated with a young lady who was taken down in a short time with putrid diphtheria which proved fatal.

In this outbreak of diphtheria we exercised great care to confine the disease to the houses which were already affected. For this purpose the infected houses were placarded, patients were isolated as much as possible, thorough disinfection was rigidly enforced, infected clothing was boiled or burned, and as a result we feel quite sure that much dreaded disease has died out. There are a number of persons in our town who believe that diphtheria is not contagious, and this made our work harder than it otherwise would have been. Many of our townsmen rendered valuable aid.

WESLEY.

Members of the board: H. F. Day, Secretary; A. J. Coffron, Chairman; J. W. Day.

Measles and "rash" have been prevalent.

WESTBROOK.

Members of the board: H. K. Griggs, Secretary; A. H. Burroughs, M. D., Chairman; John Swan, M. D.

The population of this town is 6,570. There have occurred 124 deaths, thus making the mortality 19 per 100,000 inhabitants.

Cases of the contagious diseases reported: typhoid fever, 27; measles, 9; small-pox, 10. The typhoid fever manifested itself generally in a mild form, and but one death was reported from that cause. Most of the cases occurred in October and November.

One case of diphtheria which resulted fatally occurred in a French family and was not reported. Preparations were being made for a public funeral. When the fact became known to the local board, different arrangements were made. As everything relating to the outbreak of small-pox in this town a year ago is already known to the State Board it will not be necessary to enter into details here. I will say, however, that the most efficient measures were taken to disinfect and destroy every possible source of contagion. It has been a costly experience in the matter of dollars and cents, and from it other towns may learn that a few dollars spent in precautionary measures is good economy.

In the building of a new school-house the past year more attention has been given to the matter of ventilation than has usually been bestowed upon that very important feature of school-house construction. Something has also been done to remedy the defects in this direction in some of the other school buildings in the town.

Since the law was enacted creating local boards of health there has been a manifest increase of interest concerning many things pertaining to sanitary improvements and conditions, thus showing that the *law* itself is an educator.

(Because it is of interest we quote the following from the annual report of the same local board of health to the municipal officers. A. G. Y.)

Early in January, 1888, a family, consisting of three persons, were successively taken sick with what was pronounced the chicken pox. The disease manifested itself in so mild a form that the physicians were deceived in regard to its real nature and no precautions were taken in regard to it. In a few weeks, however, others, residing in the vicinity, were taken sick. And early in March three cases appeared simultaneously, followed in a few days by two others, which cases were decided to be the small-pox. Circumstances certainly seemed to indicate an extensive outbreak of this most repulsive disease, but prompt resorts to vaccination and isolation proved effective in restricting this malady.

No expense has been spared to conquer the enemy. All furniture, bedding, wearing apparel, etc., in fact everything which could not be disinfected and thoroughly cleansed, has been destroyed by fire. The local board are confident that no remnant of the disease has been left behind as a source of danger in the future. The proprietors of the paper mills were prompt and ready in co-operating

with the local board in every measure taken for the suppression of the outbreak and were generous in assuming expenses far beyond any requirement of the law. One fact in connection with this matter is worthy of being remembered as an argument in support of vaccination. The only two victims of small pox, in its most repulsive form, were two that had neglected the precaution of being vaccinated three years previous when vaccination was general through the town. It will be seen by the report of the selectmen that this visitation caused a large bill of expense to the town. The town was totally unprepared to meet such an emergency, so far as owning any building that could be used as a hospital, where patients could be removed in the early stages of the disease, when it could be done with safety. The local board in the settlement of claims against the town have been called by public sentiment to determine upon a great many bills concerning the adjustment of which the law is silent.

Persons were placed in quarantine not for their own safety, but to protect the public, and the most of them were persons dependent upon their daily labor for support. Several hundred dollars worth of property was destroyed in accordance with the law. It seemed hard that these people in moderate circumstances should bear the loss, hence many of the bills were approved on the principle of equity and the financial agents of the town concurred. In view of the threatening aspect of the calamity at one time, the town may consider itself fortunate that the disease was brought under control at such an early period.

A building has been erected on land owned by the town, which, in case of a future emergency, can be at short notice fitted up as a hospital.

WESTPORT.

Members of the board: Stephen P. Webber, Secretary; James Thomas, Chairman; W. M. Pierce.

No cases of the infectious diseases have been reported.

WHITEFIELD.

Members of the board: John S. Ryan, Secretary; W. Johnson, M. D., Health Officer; Chas. F. Choate.

We have had four or five cases of diphtheria and one of typhoid fever, but no deaths from these causes. The local board has

always acted promptly to see that proper disinfection and other preventive measures were secured. I report the number of cases of diphtheria as four or five for the reason that in addition to the cases which were reported to the State Board I learned of two other cases which were said to have occurred in a distant part of the town, but which were recovered before I learned of them.

Whiting.

Members of the board: W. I. Crane, Secretary; A. M. Crane, Chairman; Judson Hall.

No work has been made for the board by infectious diseases.

Whitneyville.

Members of the board: D. W. Rollins, Jr., Secretary; Jas. Pope, Chairman; W. M. Flynn.

Scarlet fever has been prevalent with approximately twenty-three cases and one death. There was one very mild case of typhoid fever. The prevalence of scarlet fever was largely due in our opinion, to the mild form it assumed, thereby taking away the dread which was excited by the more malignant type and leading the people to greater carelessness as regards exposure. The one fatal case which occurred seemed to arouse the people to a realization of the fact that it was really scarlet fever, and the contagion ceased. We placarded infected premises, gave advice, notified school teachers, and finally closed our school.

There were several deaths among swine in the early part of the year. Weakness of the limbs, blindness, loss of appetite and redness of the skin were the more prominent symptoms.

Williamsburg.

Members of the board: R. J. Williams, Secretary; F. E. Dunning, John R. Foulkes.

Two cases of scarlet fever in a mild from occurred.

Willimantic.

Members of the board: Frank Hart, Secretary; John Davis, Chairman; A. D. Wentworth.

We had one case of diphtheria which was rapidly fatal and one case of scarlet fever. The infection which gave rise to the case of

scarlet fever was brought in clothes from Kennebec and the woman who helped wash them took the disease.

Our town is thinly settled and very healthy. The well water in many instances is not so pure as it should be, but is tainted by the barn yard and sink spout drainage.

WILTON.

Members of the board: A. B. Adams, M. D., Secretary; J. T. Wilkins, 2nd, Chairman; F. E. Atwood.

Two cases of nuisance were reported and removed. One fatal case of diphtheria occurred and we had five cases of typhoid fever. Not more than one case of typhoid fever occurred in one family. We have looked after the condition of every house and had everything removed that would in any way tend to hold or extend contagious diseases.

WINDHAM.

Members of the board: J. D. Harper, M. D., Secretary; C. W. Bailey, M. D., Chairman; A. N. Witham, M. D.

Two nuisances were removed. One case of diphtheria was imported and ended in recovery. Two cases of measles also occurred. Cases of the infectious diseases are isolated, and disinfection is practised as is recommended by the State Board of Health.

One death occurred from the poisoning resulting from a horse bite, and three persons were killed by the explosion of the powder mill.

WINSLOW.

Members of the board: Albert Fuller, Secretary; G. S. Paine, Chairman; J. W. Bassett.

Eight nuisances were reported, but all were removed. Three mild cases of typhoid fever occurred.

WINTERPORT.

Members of the board: C. F. Atwood, M. D., Secretary; Joshua Treat, Chairman; Joseph H. Carleton.

Two nuisances were abated. Four cases of diphtheria occurred, two of which ended fatally, and we had five cases of typhoid fever, with one death.

For the improvement of the sanitary condition of the town I can suggest no practical means except a general diffusion of sanitary knowledge which must underlie all advance in this direction. All the literature furnished by the State Board has been distributed. This I regard as most important. Give us more.

WINTHROP.

Members of the board: A. P. Snow, M. D., Secretaiy; Col. C. A. Wing, Chairman; Geo. R. Smith.

Two nuisances have been reported and removed. Two mild cases of typhoid fever occurred. The board has several times inspected different localities in the village where there were likely to be unsanitary conditions; and have from time to time made suggestions to householders and others for the improvement of their premises.

WISCASSET.

Members of the board: C. A. Peaslee, M. D., Secretary; B. R. Brown, M. D.

One mild case of scarlet fever was imported from Boston and was prevented from spreading by isolation.

WOODLAND.

Members of the board: D. A. Snowman, Secretary; N. W. Stover, Chairman; Andrew Johnson.

The town is in a healthy condition and we have had no cases of the infectious diseases.

WOODSTOCK.

Members of the board: C. B. Rankin, M. D., Secretary; A. P. Bowker, Chairman; A. L. Rowe.

One nuisance was removed. We have had four cases of diphtheria, two of which ended fatally. Three of the diphtheria cases at least appeared to be due to bad sanitary surroundings.

WOOLWICH.

Members of the board: Rev. H. O. Thayer, Secretary; S. P. Buck, M. D., Chairman; Howard Corliss.

Two cases called diphtheria by the attending physician were not reported to the local board. We had two cases of scarlet fever and two of typhoid fever. One of the typhoid cases ended fatally.

Yarmouth.

Members of the board: R. Harding, Secretary; W. W. Thomas, M. D., Chairman; Chas. T. Grant.

Geo. W. Hammond, Esq., one of the proprietors and superintendent of the Forest Paper Company in Yarmouth, a practical man, and one very much interested in the sanitary condition of our village, has built on his grounds fronting Main street a beautiful and costly private residence and has completed a main sewer consisting of twelve-inch salt-glazed pipe running through his grounds from Main street to Royall's river, a distance of eleven hundred feet. The Royall's River House is connected by a pipe with this main sewer and also the residence of J. Y. Hodgdon. Mr. Hammond says the main pipe is large enough to drain the whole village if the proprietors will only join and come into it, which I think they will soon see the necessity of doing.

Thirteen nuisances have been reported and they have all been removed to the satisfaction of the board. We have had three cases of typhoid fever, one of which terminated fatally. What we need is a water supply followed by a system of sewerage and the abandonment of all the wells in the village.

Sanitary Methods in Portland.

By GEO. C. BURGESS, Secretary and Executive Officer of Portland Board of Health.

In reply to your request for a special report on some of our work I beg to submit the following:

INFECTIOUS DISEASES.

In the first place we recognize the fact that physicians are, as a class, very busy people, and to facilitate the making of returns the board furnishes all physicians with postal cards already directed to the secretary of the board and with blank form corresponding to that furnished by the State board, printed on the other side, so that the labor of making returns is reduced to a minimum. We receive many reports, however, by telephone and some by personal calls at the office.

Having received a report of the case our first care is to send the inspector to the house, to card the house if it is a case of scarlet fever or diphtheria, to obtain information with regard to name, age and sex of the patient which may have been omitted by the physician, to leave with the family the circulars of the State Board of Health, and to make such suggestions with regard to sanitary surroundings, isolation of the family, &c., as may be called for by existing circumstances.

The superintendent of schools is informed of the case by special card, that he may take all necessary precautions to protect the children attending the public schools. The conduct of the case and directions for fumigating and disinfecting the premises are left entirely with the attending physician and it is only upon his request or direction that the card is removed from the house. If the family is unable from lack of means, or if parties desire to have the work performed for them, the board will send an experienced man

to fumigate and disinfect the premises. If the previous visit of the inspector has shown that a general cleansing of the premises is advisable, it is done under his direction after they have been fumigated and disinfected.

Inspection of Nuisances.

The inspector has an office separate from that of the secretary, but complaints are received at either office. If the matter is one requiring investigation, entry is made on a proper blank (see Exhibit "A") and the result of the examination, report and disposition of the case, entered thereon and filed for reference. By this means no complaint fails of attention or gets out of sight and forgotten, and members of the board, not conversant with the current business, may, by going over the file inform themselves.

But many long suffering people are not willing to make complaints to the board, preferring rather to suffer great annoyance and discomfort, so that in intervals of other work, the Inspector continues his house to house inspection, examining the premises with reference to yards, privies, privy-vaults, water closets, drainage, cellars, water supply, &c., making the return on a blank furnished for the purpose (see Exhibit "B"). While engaged in this matter the inspector is enabled to give to tenants and owners of buildings much good advice regarding sanitary arrangements and conveniences. In a very great majority of cases attention only needs to be called to a nuisance to have it removed, but in some cases it requires personal solicitations of the Inspector and some argument to convince people that a long standing nuisance ought to be abated. When all other means fail a formal order of the board communicated by the Secretary, accompanied by a copy of the Rules approved by one of the Justices of the Supreme Court, has, thus far, accomplished the desired result. Amongst the cases most difficult to manage, are those where premises are owned by non-residents, who have no resident agents to act for them ; but even in some of these, we have instances where owners have made a visit to the city, and remained here at considerable expense while neglected properties were put into better condition.

Disposal of Garbage.

With this the Board of Health have nothing to do, the whole matter being under the control of a committee of three Aldermen, who have contracted for the removal of garbage and house-offal for

a term of three years. How well it is done we have no especial means of knowing.

Cleansing of Privy Vaults.

Up to last May the method used here was the old one, viz., closed wagons which were filled and hauled away in the night time. It was a very offensive method and the cause of many complaints.

In May the entire regulation of privy vaults was, by ordinance given to the Board of Health, and the members having seen the September previous at Lowell, Mass., an improved system, resolved to try a part of it in this city. The use of an odorless excavator was not deemed advisable at least at present, but it was thought that the system of "pitting" in barrels, the work to be done entirely in the day time might be and ought to be a great improvement on the old method. Accordingly in licensing parties this spring it was on the condition that all work should be done in the day time and the contents removed in air-tight oak casks with metal heads firmly clamped down on rubber gaskets. Deodorizers like crude carbolic acid, or a preparation manufactured in Lowell, called El-a-tol or substance equally effective were ordered to be used to overcome and destroy the effluvia of the vaults.

This system has now been in use since May last, and we have no complaints of the prosecution of the work in the day time. A screen of canvas shuts off the view of the men at work, and the work is done in comparatively crowded neighborhoods and the barrels carried away through our most frequented streets with no knowledge on the part of the public of the nature of the business which is being transacted. In fact, if it did not sound like a huge joke, to tell what is literal truth, our licensee has more than once been stopped while engaged in his legitimate business, under the charge of "illegal transportation of *beer*."

We confidently recommend this method to all cities and towns as a very simple and unobjectionable way of doing this woik.

Our records show that we have attended each year to more than one thousand well founded complaints of nuisances, and this year has been no exception.

One would naturally say that with so much work done in previous years there would not be so much to do in the present, but aside from the fact that much of the work is of a nature which must be done over each year, it is plain that the public has become so edu-

cated that it will not endure annoyances and dangers to health which it once submitted to with more or less patience.

Before the creation of local boards of health, complaints were few, for little attention was paid to them, and when our first municipal board was created, it was thought that the police department could easily deal with all the complaints; but each complaint promptly attended to and remedied, brought a score, pleading precedent to have theirs also remedied, until the city marshal said that if he were to attend to all complaints of nuisances, there would be little time for him to attend to other duties. The creation of local boards of health, with ample powers to deal with nuisances affecting the health and comfort of citizens is therefore a necessity, because the evils with which they deal have heretofore been met and suppressed, by methods too cumbersome for ordinary use.

What the effect of the present efforts may be upon the death rate it is as yet too early to determine, but we may hope for a reduced percentage, but at any rate one result has been accomplished, namely, that in many ways the comfort of citizens has been greatly increased.

[*Exhibit* "A"]

188 . No. ....

Date, ...

Complaint

By ....

of premises situated at

No.. .... Street.

Owned by ....

Investigated by..................... ... .

....

REPORT.

....

....

Disposition of Case.

....

....

....

(and on the other side (or inside) of the sheet the following :)

188 . No.........

Date,.. ..

Complaint made by

....

of premises situated at

No..................................... ....Street.

Owned by...

Occupied by........ ... .

Nature of the Complaint.

....

....

....

....

[*Exhibit* "B"]

CITY OF PORTLAND.

Sanitary Inspection *of Premises No*...... ....*Street,*
Used as...
Owner or Agent ....*Date*,........ 18

(UNDERSCORE THE WORDS NEEDED.)

1. **Yard.** Very Clean. Decently Clean. Dirty. Filthy. Wet. Dry.
2. **Privy.** Clean. Filthy. Light. Dark. None... .. ....
3. **Privy-Vault**..........feet from nearest dwelling. Adjoins a dwelling. Under a dwelling. None. Brick. Stone. Wood. A box or tub. A hole in ground. Full, or nearly so. Recently emptied. Kept decently. Bad odor. Drained to public sewer.
   Repair.—Good. Fair. Poor. Ought to be replaced immediately.
   Ventilation.—Good. Bad. None.
4. **Water-closet.** Pan. Hopper. Washout. Clean. Filthy. Light. Dark. None.
5. **Drainage.** To public sewer. Cesspool. Surface of ground. Barn-cellar. Privy-vault. No sewer within 100 feet. Drain leaks in Cellar. Drain stopped. Slop-hopper needed. Urinal needed. Urinal well kept. Filthy...
6. **Cellar or Basement.** How occupied?..... ....
   Dry. Damp. Wet. Clean. Dirty. Filthy. Dark. Light. Ventilated. Unventilated.
7. **Barn-Cellar.** None. Well-kept. Needs cleaning. Used in part as a privy-vault. House drains into it. Wet. Dry..
8. **Water-Supply.** City. Well. Under the house. ...... feet from house. From barn-cellar. From privy-vault.
9. **Size of Lot.** ... No. of people by day.... No. by night..
10. **Animals.** Swine.....Horses....Cows... Fowls....
11. **Remarks**..

....
..........................*Inspector.*

Portland, ...18 . *I this day notified*....................
....*above named*................. ....
....
........................*Inspector.*

Report of the Committee on the Pollution of Water Supplies, Appointed by the American Public Health Association.

Read at the Annual Meeting at Milwaukee, Wis., November 20-23, 1888.

In its report at the last meeting of the Association your committee explained in brief the ground of its belief in the harmfulness of sewage in waters used as potable supplies, whether these were derived from wells or larger sources; whether the water-supply of an isolated dwelling or that of a populous city. Chemical analysis was shown to be in most instances inadequate to the detection of sewage, unless the sewage was present in unusual quantity, or the water unusually free from other organic matters; and the conclusion was reached that the inability of the chemical methods is of no practical importance, as the presence of sewage in the water-supply can be determined by the sanitary inspector; and further, that for protective purposes the knowledge that sewage enters the water is all that seems to be required, because where there is sewage there is danger of typhoid infection.

Your committee desires to give special emphasis to the last stated clause, because it believes that the endemicity of typhoid fever in our cities is in great part due to the sewage in the water-supply. Many of our public water-supplies contain sewage, and its harmfulness in a general way is unquestioned even by those who have a financial interest in them. Yet there appears to be a hesitancy to acknowledge the real, the specific, danger. Typhoid fever is present in all our cities, giving annual death-rates of from 15 to 100 and over in every 100,000 of the population; but in the enumeration of its causes its prevalence is ascribed to many insanitary conditions before mention is made of the public water-supply. It is allowed in certain local epidemics to be propagated from wells which have become infected by an infected sewage, but the sewage in the pub-

lic supply is seldom considered other than as a sentimental objection to the use of the water. It is allowed in many instances to arise from leaks in the plumbing of houses, by which exhalations from infected sewers reach the interior of the dwelling, but the water-supply into which the sewage of these very sewers is poured is used without a thought of its deadly qualities, unless, as in the case of Plymouth, Pa., the fact is forced upon the public mind that a public water-supply has as little disinfecting power over the germs of typhoid fever as the private water-supply of an infected well. Health officers condemn the well, and generally it is closed as soon as it is found that sewage percolates through its area of drainage; —they should condemn the public supply on the same grounds.

The large financial interests involved in the establishment of a public water-supply may be assumed to be at the bottom of this hesitancy to acknowledge the specific danger attaching to the presence of sewage. Millions of dollars, perhaps, have been invested in that water supply, and many more millions would be required to replace it by water from a purer source. These large sums are alone considered, and not the vast and annually increasing totals of the loss by sickness and death that might have been prevented. A public or private well involves but a small sum, so small that it does not stand in the way of sanitary progress. It is closed, and with its closure one more possible centre of typhoid infection is removed; but the decreasing influence exercised by this on the annual rate of prevalence is small indeed if the public supply continue to disseminate the disease. The dollars and cents represented by the existing water-works may be regarded as a barricade to sanitary progress, or an altar on which typhoid fever sacrifices its victims.

The efforts that have been made from time to time to quiet the public mind by demonstrating the destruction of sewage and the self-purification of the water which contained it, are in part attributable to these financial interests;* but only in part, for many sanitary inquirers have been deceived by partial or imperfect observations. Unfortunately, however, those analysts who have had much practical experience in following the track of sewage in its passage down-stream recognize in this so-called self-purification only the results of sedimentation and dilution. Undoubtedly the natural processes of purification,—the transformation of organic matter into ammonia, and the nitrification of the latter,—operate in the current of a running stream; but these account for but a small proportion

of the seeming purification, and there is no ground for supposing that the infectious principle of typhoid fever is given up to the action of these purifying agencies. We acknowledge that typhoid fever is propagated by an infected sewage in a well-water when all organic trace of the sewage has disappeared through the instrumentality of the agencies referred to. There are two kinds of organic matter in the dangerous sewage,—matter which, by the absence of life, is given up to decomposition and reduction to harmless inorganic forms, and matter which by its vitality is preserved from these influences; and we acknowledge that in the well-water the former may be reduced, while the latter retains the full measure of its virulence. Analogy shows conditions of a similar character affecting our river-supplies, and the seeming apathy with which they are regarded can only be accounted for by assuming that individually we have fought against the barricade erected by the dollars and cents, and been defeated by its solidity and strength.

In this country the relation between the distribution of a water which contains sewage and the prevalence of typhoid fever can be readily observed by any one who studies the mortality returns of our cities in connection with the *character* of their water-supply. The records in many instances are complete and trustworthy for the past twenty years. Brooklyn, New York city, Boston, Cincinnati, Philadelphia, etc., have a death-rate from typhoid fever proportioned to the quantity of sewage which enters their water-supplies. Where the water-supply, as in the first mentioned city, is free from sewage, the death-rate is low, about 15 in every 100,000 of the population, these cases being due to indirect infection and other local causes. When care is exercised in excluding sewage from the water-shed which furnishes the public supply, there is a corresponding freedom from typhoid fever, as in New York, which has a death rate of 25, and Boston, which loses about 40 annually for every 100,000 of her people. In Philadelphia and other cities, in which less attention is given to the purity of the public supply, the typhoid death-rates are correspondingly increased. Moreover, the records of some of these cities give interesting information when viewed in connection with the *history* of the water-supply. The city of Baltimore has had a steadily diminishing rate since its water-supply was first introduced, and this decrease has been more notable since 1880, when the supply was largely extended. And this same city of Baltimore shows that its improved condition is not due to the introduction of a system of

sewerage, but to the use of a purer water than was formerly furnished by its infected wells. Ordinarily a sewerage system and public water-supply are contemporaneous improvements, and heretofore any benefit to the health of the community has been credited to the sewerage, although it seems as if the inflow of a wholesome water had really more to do with the lessened death-rate, for the small typhoid rate of New Orleans, Louisiana, cannot be attributed to the sewers of that city, since it has none; but it *may* be attributed to the water-supply, for that consists of rain-water, which is free from sewage inasmuch as the cisterns in which it is stored are not sunk in the soil, but raised considerably above the surface.

Testimony of a similar character has recently been developed by the experience of Vienna. In that city, from 1851 to 1874, well-water of an impure character was used to a large extent in addition to a systematized supply from the Danube. During this period the deaths from typhoid fever ranged from 100 to 340 annually in every 100,000 of the population. In the last mentioned year a spring-water was introduced, and the death-rate from typhoid fever fell immediately to 50. Since then, by the disuse of impure wells and the extension of the new supply, the rate for the past three years has fallen to 11; and, inasmuch as the sewerage system was in existence during the period of high rates, the fall since 1874 is necessarily referred to the use of a water which is free from sewage. The fall in the typhoid rate experienced an interruption in 1877, when, owing to the freezing of some of the sources of the spring-supply, the water of the Danube had to be pumped into certain of the mains; and it is of importance to observe that the sections of the city which were chiefly affected by the epidemic were those in which the Danube water was distributed. According to Professor Nothnagel, typhoid fever has become such a rarity since the introduction of the spring-supply that when a case occasionally comes to hospital from outside the city he shows it to the students as one of unusual interest.

In the face of such testimony to the influence of a pure water on the typhoid rate, we cannot shut our eyes to the relation that exists between sewage in our streams and typhoid fever in the cities that are supplied by them, no matter how great may be the financial interests that are involved or sunk in the contaminated supplies. Now comes the inquiry, What are the measures that have been or should be adopted to lesson the evil?

As a rule the only effort made by our municipal authorities and water companies to purify our public supplies is by sedimentation. They select a pond which forms a natural sedimenting reservoir, or they throw a dam across a stream to form an artificial one, or in the case of large water-courses, they pump directly from the stream into specially prepared basins. Primarily these basins or reservoirs were intended to facilitate distribution and guard against a temporarily inadequate flow in the stream which furnishes the supply; but they were found to answer the purpose of clearing, and to that extent of purifying, a turbid water, provided they were large enough to permit the water to remain undisturbed for the needful length of time. When it is proposed to have additions made to the water-supply of a city, the construction of new basins is usually implied. As an instance, there are now at the city of St. Louis, Missouri, four settling basins, holding eighteen million gallons each. The floors are paved with brick on edge, and slope towards the centre and the river side. The sediment is floated off from the floor of each basin once in about four months, the quantity removed annually amounting nearly to 200,000 cubic yards. The wants of the city permit the water to settle only from eight to eighteen hours, while a period of thirty hours is required for a satisfactory subsidence. On this account an extension of the work is at present in contemplation. Surveys have been made, and land purchased for larger settling-basins and conduits to carry the water to the present high-service or clear-water pumping-plant. The estimated cost of these improvements is three and a half million dollars.

The storage of a turbid water in such basins undoubtedly tends to improve its quality. No argument is required to show that the St. Louis water is better with its suspended matters at the bottom of the reservoirs than choking the distributing pipes, collecting in every containing vessel in the city or settling in the alimentary tract of the water consumers. The subsidence of the inorganic matters which constitute the mass of the turbidity carries down a considerable proportion of the associated organic materials, and the clear water gives markedly better results as well on chemical analysis as on bacteriological examination.

Chemically considered, the tendency of the cleared water is to further purification. Organic matter steadily diminishes in quantity, and is replaced by ammonia and nitrates; but as this is effected by bacterial agencies, biologically the stored water progressively deter-

iorates after it has become clear by sedimentation. The bacteria increase at the expense of the organic matters which they destroy. A water which every chemist and every bacteriologist would pronounce a fair sample of potable water will be found, after a week of storage, to be swarming with bacteria. Daily experience forbids the condemnation of a good water merely because it has been stored for a week; yet the bacterial colonies that may be developed from it are infinitely more numerous than those that are found in a water which is impure even to the senses. Indeed, the bacteria in an ordinarily pure water, after storage, may be vastly more numerous than in another portion of the same water intentionally contaminated with sewage or other impurity and similarly stored for the same length of time. This it is which deprives the bacterial cultivations of that value which but a short time ago they were expected to develop as indices of the wholesomeness or unwholesomeness of a water. A chemical evidence demonstrating a tendency to purification by the conversion of organic matter into nitrates, through the instrumentality of bacterial organisms, is more consistent with every-day observation than the bacteriological evidence which suggests unwholesomeness by demonstrating the numbers of the bacteria.

But although the general tendency is to the reduction of organic matter in stored waters, it often happens, particularly if the water is rich in ammonia or easily decomposed albuminoids, that vegetable growths other than bacteria will be developed, giving a bad taste or odor to the water, and perhaps causing diarrhœa in the consumers. These, which may be considered the accidents of storage, have been studied by many health boards and water companies; and the influence of heat, aeration, exposure to sunlight, etc., on their development, has been determined with practical benefit in many cases.

Sedimentation is sometimes an exceedingly slow process, particularly when the mineral particles consist of finely divided clay. A week or more is required in some instances to give a clear water, and this involves a large expenditure of storage-basins. Hence, many have turned their thoughts to filtration as a prompt and efficient means of purification. Filtering-beds are in general use in England, but in this country they have been constructed only by a few cities, and in an experimental way. The results do not appear to have been satisfactory. The expenses attending them are large, and the

coldness of our winters begets difficulties which have not to be encountered in the milder climate of England.

But the failure of filtration on the large scale, and the imperfect results of sedimentation as carried on in the reservoirs, have given an impetus to the construction filters for domestic use; and the success which has attended attempts to supply a clear water to manufactories and other large establishments has gradually led to more ambitious efforts. Of late some municipalities have investigated the means by which this filtration is effected; and the ability of the filters to supply a clear water on the large scale appears to have been demonstrated. As the method is patented, a certain hesitancy has been manifested by members of the Association in referring to it; but, patented or not patented, if it have a value above others in supplying a pure water, we should have full accounts from such of our members as have a practical knowledge of its operations in all their aspects. A member of the American Water Works Association did not hesitate, at its last meeting, to invite attention to the success achieved at Atlanta, Georgia. He expressed himself as knowing but little of the chemical improvement that took place in the quality of the water, but so far as the mechanical results of the filtration were concerned he was perfectly satisfied. The surface of the water in the impounding reservoir is nineteen feet above the layer of coke and sand which constitutes the filter-bed, through which it is carried by gravity into the clear-water basin. The reservoir-water is generally so muddy from red clay and other suspended impurities that it is rarely fit for bathing or laundry uses; yet in the clear-water basin small objects may be plainly seen through it at a distance of twenty feet. The capacity is three million gallons daily, although the quantity actually filtered for distribution at the time of the report was only two million gallons. The cost of the filters and clear-water basin was $55,000, and the daily expenses eight dollars for alum and two dollars and fifty cents for labor.

So much experience has been gained in the construction of these filters that filtration can no doubt be effected more rapidly and economically under the supervision of the patentees, than on new plans which must be at first regarded as merely experimental. But if the attention of boards of health, water companies, and sanitary engineers were directed to the development of the best filtering-plant, other and better methods might be suggested and carried into practice; or, if the patent process were proved to be superior to

all others, the ability to express a prompt approval would be substituted for our present hesitancy. The passage of water through a filter-bed, the regular cleaning of the filtering material, and the addition of alum, iron, lime, or other precipitant, to the water, are the essentials of the process; but the patents necessarily cover only the specific mechanism by which these are brought into operation in that particular process. The natural laws of filtration, and of mechanical and chemical action, are open to the ingenuity of the world.

Recently Mr. L. H. Gardner, of New Orleans, has been experimenting on the large scale with solutions of iron, not as an adjuvant to filtration, but to hasten sedimentation in the settling-basins. Iron as a precipitating or filtering agent has been used in various forms and to a considerable extent, on the large scale, as a water-purifier since Medlock, in 1857, patented a process in which water was treated by contact with metallic iron. Spongy iron attained even a popular repute as a filtering material, but at the present time in Europe it has been displaced by the Anderson process which is said to be in successful operation at Antwerp, Ostend, Paris, and Vienna. The water in this process is first partially sedimented and then forced through a revolving purifier consisting essentially of a wrought-iron cylinder mounted on hollow trunnions, which serve for inlet and outlet pipes. Curved ledges, running lengthwise of the cylinder on its inner surface, scoop up and shower down fine borings of cast-iron through the current of the water. By the combined action of the cylinder and the water-current every portion of the latter is brought into contact with the iron, the particles of which are kept constantly bright by friction against each other and the sides of the cylinder. After this the water is passed through sand filter-beds to remove excess of iron. The results claimed are that the organic matter is altered in its chemical nature, and the albuminoid ammonia lessened from one-fourth to one-half of its original amount; that the water is softened, the scale in boilers becoming greatly reduced, open, friable, and loosely adherent to the plates; and that the microscopic life of the water is, to a large extent, destroyed or removed. At Antwerp the quantity of water thus treated is two million gallons daily, and the engineer in charge of the works and the municipal authorities have expressed their satisfaction with the results attained.

The various methods of purification by iron that have been tried in Europe involve the contact of the water with natural or prepared ore or cast-iron borings or turnings, with a subsequent filtration through sand to eliminate any excess of iron; but Mr. Gardner has suggested the introduction of a solution of iron in the precise quantity needful for the desired purpose. He tried a solution of red hæmatite ore in hydrochloric acid on Mississippi water at the New Orleans water-works, and the clarified water gave satisfactory results to Professor Chandler, of New York, and other chemists. Later, he treated a body of thirteen million gallons in the St. Louis settling-basins. The solution used, the water in various stages of precipitation, and the clear resultant water, all met with favorable reports from the analysts. The action is chemical, not mechanical. The combinations of lime and magnesia in the Mississippi water become converted into chlorides by the chlorine of the iron solution, and the pricipitated oxide of iron settles promptly, carrying the suspended matters with it, and leaving the water clear. A solution of the specific gravity 1.6 in the proportion of one part to 20,000, clarifies the muddiest of river-waters without hardening them or leaving in them any excess of the precipitant. The Mississippi water at New Orleans can be thus clarified by a rest of eight hours in the reservoir at an expense of one cent for every thousand gallons. Mr. Gardner's object at the present time is to procure a cheaper iron solution.

In the efforts to attain to a prompt and efficient method of purifying water by sedimentation or filtration, with or without the use of precipitants, it is of the utmost importance that the object of the purification be kept steadily in view lest we fall into the error of supposing that the end has been accomplished when a clear water has been obtained. The agents of a certain patent filter place in the show windows of some prominent store two companion glass jars, one filled with an opaque and discolored turbidity overlying a stratum of heavy sediment, and labelled "Water taken this morning from the public mains;" the other, sparkling like a consolidation of dew-drops, and labelled "The public water after passing through so-and-so's filter." A glance at these gratifies the passer by, by seeming to instil into his mind so much sanitary knowledge. They sow seeds of reflection which develop and multiply with bacterial fecundity, so that in a few minutes they have done the work of an octavo pamphlet on "Potable water: its

impurities and the methods by which they are removed." But the sparkle of the filtered water, although honest in itself, hides a fallacy which undermines the whole of the suggested argument. It must be remembered that clear waters are not necessarily wholesome waters. Their sparkle is no proof of their purity. From the laundresses' point of view, or the paper-makers', the result is satisfactory; but the object of the filtration of a water supply for domestic or public service is its wholesomeness when used for drinking, and its transparancy gives no testimony on this subject.

During sedimentation the heavier and grosser particles of mineral matter readily subside, and carry down with them much of the flocculent organic matter which would otherwise continue in suspension for many days. The effect of sedimentation at St. Louis, Missouri, has been mentioned, but it will perhaps be better appreciated when stated in other words. The lake-supply of Cleveland, Ohio, which is usually of excellent quality, is occasionally turbid, particularly during the spring months. When in this condition of turbidity the twenty million gallons, which are distributed daily, contain ten and a half tons of suspended matters, and the odd half ton consists of decomposing organic substances. Who will say that the city of Cleveland would not be benefited if it did not have that daily distribution of half a ton of semi-putrefaction? But sedimentation does more than free the water from suspended matters. During the so many hours or days of its continuance the processes of nature are at work transforming the semi-putrified matters into ammonia and nitric acid, both of which are harmless in the quantities present. The purifying influence of sedimentation may be easily determined by chemical analysis, and in many cases it is so marked as to render the process of infinite value in the absence of a better method.

Most surface waters, which are turbid from particles of mineral matter, contain the germs of nitrification, and the process of purification takes place in them during storage; but if these germs be absent, months may pass with but little improvement in the character of the stored water. Hence, cisterns which do not contain these bacteria have usually a less pure water, as judged by the ammonia and albuminoid ammonia which it yields, than those which do contain them. Where wooden tanks, as at New Orleans and other southern towns, are used for storage, it is a common occurrence for the analyst to find water of poor quality in new or recently cleaned

cisterns, while water of a much better quality is discovered in those that have not been cleaned for a year or two, and have a fermenting sediment a foot or more in depth covering their floor. The nitrifying agencies accumulate with the sediment, and, notwithstanding the sediment, they succeed in reducing the organic matter of the water to the inorganic condition. The sediment is thus an advantage, but the end is better accomplished by keeping it out of the cistern and introducing the bacterial workers through the medium of a layer of clean gravel or sand.

But withal, it must be remembered that it is only organic matter in a state of decay that is thus reduced to the inorganic condition, and only organic matter in tangible form that is thus carried down by the heavier particles of the mineral sediment. Organic matters that are endowed with vitality remain uninfluenced by the destructive and reconstructive bacterial agencies that are operating in the water; and these, as has been seen, are the matters from which most is to be feared if sewage has unfortunately had access to the supply. The infected water which prostrated 1,200 of the 8,000 inhabitants of Plymouth, Pa., and killed 130 of those whom it prostrated, passed through three storage reservoirs on its way to accomplish its deadly mission.

Nor is filtration more efficient as a purifier when viewed from the stand-point which sees typhoid fever disseminated by an infected sewage in the water-supply. A satisfactory filtration removes the haze or cloudiness which may pervade a sedimented water for days after the grosser particles have subsided, and in so far its results are better than those generally effected by sedimentation. The finer particles of clay, some no larger than barely distinguishable molecules under the ordinary working powers of the microscope, are removed, and with them organic shreds of similarly minute size, and even many of the bacterial germs which were present. A water thus freed from foreign matter in suspension seems to offer the lustre of its transparency as a voucher or visible symbol of its purity, and chemical analysis may show in it only the merest trace of organic matter in solution, for the processes of decomposition and recomposition of the organic elements take place with much greater rapidity when the water percolates through the pores of the soil, as in the natural process of filtration, than when it is merely stagnant in a reservoir or flowing in the current of a stream. It is now well known that the bacterial agencies which effect these changes have

their habitat in the three or four feet of soil which constitutes the surface of the earth, and that in soaking through this layer the organic matters of a water are transformed into matters which the roots of living plants can absorb and assimilate. Chemical analysis may therefore show in such a water merely the small quantities of ammonia or nitric acid which are the results of this bacterial action, and the water may be claimed to be pure on much stronger evidence than can be advanced on behalf of any water which is massed on the surface in a lake, pond, river-bed, or settling-basin, these surface waters having at work in them only those straggling bacteria that have been washed from their habitat in the soil into the current of the stream. In fact, so far as can be demonstrated by chemical tests, the naturally-filtered water may be free from everything of an organic nature.

In view of our knowledge of the conditions needful to a perfect natural filtration, it is impossible to allow that artificial means operating after nature's methods, will ever produce as pure a supply as can be procured in suitable localities by digging a hole in the ground. Comparatively speaking, only a small quantity of rain falls on a stated area,—a depth of so many inches during the course of a year,—and of this a large proportion is turned aside for the general police of the surface, and, having fulfilled its mission, is carried off by surface channels to the ocean, while another part of the fall cools the overheated surface of the soil by its evaporation, and gives the air that proportion of moisture which is needful to the continuance of life under present conditions. Only a few inches of the annual rainfall penetrates the soil, and, escaping the roots of the living vegetation, collects on the surface of some impervious stratum as the surplus water poured into a flower-pot drains into the saucer below. Artificial filtration has neither the time nor the surface to effect percolation after nature's method. Filtering-beds of gravel are prepared which permit more water to pass through them in a day than nature percolates through the same area in a year, or special filters are constructed which transmit, under pressure, as much water in half an hour as nature purifies on the same area annually. The bacteria of nitrification cannot be harnessed to the work of artificial filtration, and hence the results of such methods, although manifesting a satisfactory freedom from suspended matters, can in no instance compare with the organic purity which characterizes the spring and well-waters that are found in the

laboratory of nature. Since the bacteria of the artificial filtering-beds are unable to deal with the organic matters dissolved in the percolating water, it is needless to expect them to reduce the masses of organic matter which in process of time clog the filter with their accumulated foulness, and lessen its efficiency as a filtering medium. The artificial filter cannot, therefore, furnish a water which will be as pure as a naturally pure water. In fact, artificial filtration amounts to little more than the mechanical separation of a water from its suspended particles, while the essential of natural filtration is the thorough nitrification of the albuminoids of the water, the removal of suspended matters being incidental and merely secondary.

The decay of once living organisms, animal or vegetable, gives more or less taint of a putrefactive nature to the surface-waters of the earth, and this taint, when of sufficient strength, is known to induce diarrhœal tendencies in the human system. Moreover, among the fermentations which take place during the destruction of organic matter, is one which gives origin to an influence,—the malarial,—which is always disabling, and often deadly, to human life, pervading the surface-waters to a dangerous extent, particularly in warm climates and seasons. By the process of filtration nature removes both the putrescent and malarial taints from the water, yielding a supply which is held to be pure and wholesome by the ever-increasing testimony of the generations of the world. The malarial influence is attributed to a micro-organism. If this view be correct,—and the tendency of medical science is to accept it as the only theory which gives a satisfactory explanation of the malarial phenomena,—the vitality of the germ should preserve it from the putrefactive and nitrifying agencies, for these operate only on dead matter. It is therefore probable that only the mechanical part of the process of natural filtration is concerned in the removal of the malarial influence from a water, and that an artificial filtration which gives satisfactory mechanical results will be of value in the prevention of malarial disease.

Although the bacteria of the soil do their work so thoroughly that no chemical trace of existing organic matter can be found in the percolated water, it sometimes happens that this water is unwholesome. When collected at a distance from the haunts of man, it is as pure as it looks, for nature's methods always suffice for her necessities; but where the activities of human life create artificial

conditions, such as result from the aggregation of individuals in cities and towns, her methods fail because they cannot be carried out. The soil becomes more and more contaminated by animal excreta, and the wells reservoirs in which are collected the leachings or washings of this impurity. If the impure soil be colonized by the infection of typhoid fever, it is immediately converted into a breeding ground for the germs of that disease. The vitality of these germs preserves them from putrefactive agencies, and their size seems to offer no obstacle to their passage through the soil. They therefore drain into the well, and confer upon its clear waters powers of a most deadly character. In the records of sanitary science are to be found many epidemics of typhoid fever chargeable to wells that have become contaminated by sewage. Indeed, the more the transmission of typhoid fever is studied, the more evident it is that the water-supply is the main agency concerned in its propagation. Hence, sanitary officers have not only closed up wells into which sewage has entered, but those which, from their situation, are merely exposed to this danger.

Since natural filtration is powerless against the infection of typhoid, it is evident that artificial methods can give no guaranty of protection.

The purifying influence of precipitation by means of such chemicals as alum, iron, or lime can readily be demonstrated by chemical analysis. The hydrated alumina, ferric oxide, and lime carbonate, as they materialize into particulate existence from their solution in the water, entangle and carry down with them organic particles that would otherwise be less easily removed; and biological research shows that bacterial germs are swept from the water in like manner. That this operation is imperfect is demonstrated by the number of colonies which can be developed from the cleared water; that it is purely mechanical and not germicidal is indicated by our experimental knowledge of the action of such substances on various bacterial organisms, and by the fact that their presence does not exercise even an antiseptic influence on the bacteria of the water, as the number of these bacteria subsequently increases in the cleared water as rapidly as in a stored water which has had no such chemical treatment. The commercial interests concerned in artificial filtration invest these substances with the title of coagulants, as if the albuminoid constituents of inorganic life curdled into a bacterial *rigor mortis* as soon as the water became pervaded with the presence

of the precipitant; but there is no warrant for a belief in any protective virtue other than that connected with a mechanical entanglement and precipitation.

The processes of purification that have just been reviewed remove suspended matters and more or less of the dissolved saline and organic substances that are present in the water, but none of them can lay claim to the removal or destruction of the causative agencies of the acute infectious diseases that are known to be propagated by an infected water-supply. These processes have been closely studied by the English sanitary authorities, who long ago came to the conclusion that sewage in a water is harmful because it may contain the germ of cholera or typhoid fever, against which the most efficient method of artificial filtration constitutes no effective safeguard. Hence, the object of sanitary legislation in England is not to preserve the rivers as a drinking-supply, but to prevent them from becoming a nuisance in their character of open sewers. The solids of sewage consist of a highly nitrogenized organic matter, the proper disposition of which in the economy of nature is as materials for the growth of the vegetable kingdom, and if these be separated, the water may be purified by percolation and filtration and returned to the rivers. Sewage has accordingly been treated in various ways for the separation of the solids and the reclamation of its water. In country houses and small communities a cesspool can be provided for the deposition of solids, the liquid overflow being conveyed by drain-pipes into the soil. The effluent water in such cases may be as pure to chemical tests as that of the stream into which it is discharged. But as communities grow, the difficulties attending the disposition of their sewage are proportionately augmented.

Various methods of precipitation have been tried with the view of paying expenses by the sale of the solids as a fertilizing material, while the separated liquids are turned into the water-courses, with or without an intermediate filtration through the soil. Sewage irrigation has also been tried on the large scale, and in many instances with satisfactory results. The advocates of irrigation point with considerable enthusiasm to the purity of the effluent water, and consider that this system will ultimately settle the vexed question of the disposition of sewage; and, indeed, such is the purifying influence of the soil, that the clear water of the outflow gives relatively good results on analysis. But, as we have seen in speaking

of sewage-polluted wells, the purity which is evidenced by chemical tests fails to give an assurance of protection from typhoid fever, and it is this protection, not chemical purity, which is the object in view. These advocates claim that typhoid fever does not prevail in the fields which receive the sewage of an infected city, but it is the propagation by drinking-water, not by exhalation, in which we are interested, and typhoid fever is known to have prevailed on fields where the effluent water was used for drinking. Indeed, how could we expect otherwise when we know that typhoid fever is propagated by an infected sewage in a well-water which has undergone a more efficient filtration through the soil than that to which the sewage is subjected in the irrigating fields, or when we remember that the spring-waters which occasioned the epidemic at Lauzen were derived from a sewage-polluted stream spread over the fields of an adjoining valley for purposes of irrigation?

In view of the considerations which we have thus briefly reviewed, we cite the opinion of the English commissioners, to give it greater emphasis as re-affirmed after the passage of years which have added much to our knowledge of the propagation of infectious diseases by means of the water-supply: "Of all the processes which have been proposed for the purification of water or of water polluted by excrementitious matters, there is not one which is sufficiently effective to warrant the use, for dietetic purposes, of water which has been so contaminated. In our own opinion, therefore, rivers which have received sewage, even if that sewage has been purified before its discharge, are not safe sources of potable water." A water to which sewage has access should from that fact alone be excluded from all further considerations as a possible water-supply for drinking purposes.

The introduction of a water-supply into a growing city is ordinarily only a question of money. Engineering difficulties fade into insignificance when surveyed from a satisfactory financial standpoint. It is often said to be beyond the power of money to purchase health, but the sanitary student can readily demonstrate that in many cases this is not so. Money expended in the distribution of a wholesome water-supply will purchase health for the thousands who otherwise fall victims to the fever which is endemic in our cities and towns. Typhoid fever is a disease to which every one is exposed. The susceptibility to it is inherent in our constitutions, and, so far as we know, immunity can be purchased only by submitting

to attack. Ordinarily the human constitution succumbs to its influence before maturity is reached, but if up to that period we fortunately escape, we have no assurance of future immunity. Uncertainty overhangs us like a cloud. Danger is as present with us in the daily routine of our peaceful lives as on the battle-field, only that the embodiment of evil is an invisible and intangible germ instead of a fast-flying bullet. Danger flows beside us in our streams, in our mains, from the taps in our houses. The germ of the disease may not be in this pitcherful or in that, in this tumblerful or in that, but it will find us some day if we continue to use the water which contains it. In a town of 50,000 inhabitants one victim is taken daily, and as the average duration of this disease is about a month, there are always in that city thirty persons whose lives are unnecessarily trembling in the balance.

What is the local suffering from yellow fever in Jacksonville, Pensacola, or New Orleans, once in so many years, compared with the totality of the destruction caused by the steady progress of this general and ever-present scourge? Thirty thousand people die of typhoid fever annually in the United States of America, and Vienna lowered her losses by this fever from 340 to 11 annually in every 100,000 of her population by introducing a spring-water supply instead of the sewage-tainted waters of the Danube. Calculate the loss by sickness associated with these 30,000 deaths,—the loss of work, the unprofitable work of nursing, and the actual outlay necessitated by each visitation of the disease,—and you will find that saving money by drinking sewage in the water-supply is a penny-wise policy that in the long run will fail to pay even for the funerals and the mourning goods.

In many instances it is, on this continent, an easy matter to obtain a suitable supply for a community. Some neighboring lake offers itself as a natural reservoir, requiring only the construction of conduits for the transmission of its waters; or an artificial reservoir may be formed by damming certain of the radicles of a neighboring stream. The drainage area of this supply must be kept under the closest supervision by the sanitary authorities of the community, for it is not enough to obtain a supply which is free from sewage: it must be kept so. Constant vigilance is the price of safety. The sanitary inspector should be ever on guard and familiar with every square yard of the surface, and the health authorities should be empowered to protect the many against the

carelessness or wanton encroachments of the few. The question of water-supply is here reduced to its simplest terms: the raising of sufficient money to bring in the wholesome water, and the investment of the health officer with power to preserve the wholesome quality of the public supply and to prevent the use of water from sources which are known to be unwholesome.

In other instances, it is difficult to obtain a suitable water-supply. The whole face of the country has been more or less settled, and the natural drainage of every valley brings sewage and manufacturing waste into its outflowing stream. Nevertheless, now is the time to act, for these unfavorable conditions will increase and multiply in the future, so that what may be done now cannot be done then without a tenfold expenditure of time and money. Fortunately, when difficulties occur from the density of the settlement, there is also more wealth to meet the increased expenditure, but it is beyond the power of that wealth to give life to those who have in the meantime fallen victims, or consolation to the hearts that are in mourning. What is to be done should in all cases be done at once. It is *we* who are interested in this matter,—now, in our own time and generation: for what does it avail us that the city is supplied with pure water ten years hence, if at that time it be remarked of us, Oh, yes, I remember him well; he died of typhoid fever eight or nine years ago. And it is an easy matter to so arrange the financial burden that part of it shall fall on those who will hereafter participate in the benefits.

In well settled sections of the country it may be impossible for the towns and villages to obtain a water free from sewage in their main streams or their neighboring tributaries, and equally impossible for any one of them to go to the nearest sources of pure water for a supply, but those favorably situated for combined action may easily perfect their arrangements for bringing in the water from long distances. Nor should it be forgotten that if water free from sewage is not to be obtained on the neighboring surface, it may sometimes be found beneath the surface, as at Brooklyn, L. I., or, more notably, at Memphis, Tenn., where, after a thorough investigation of the whole subject by a committee of citizens, it was ultimately developed that they had a source of the purest water within a hundred yards of their domestic hearths.

Many communities have a water-supply which was pure enough when originally introduced, but which has become dangerous by the

subsequent growth and development of which it formed the nucleus. A water-bed or basin cannot be used for concurrent purposes of water-supply and sewage discharge. If the drainage area be given up to settlement and commercial enterprise, with their consequent sewage and manufacturing waste, the city must be prepared to find another source of supply for its daily wants, or pay the penalty of an increased death-rate from preventable disease. In the race for material prosperity this penalty is too often forgotten, and the endemic fever is regarded as one of those visitations of Providence that are inevitably consequent upon conditions of aggregation. Yet every intelligent medical man knows the fallacy of this reasoning, and that the progress of this malady can be checked by suitable measures as surely as exotic disease can be kept out of the country by properly enforced restrictions on commerce. To permit the citizen to enjoy life, which, according to the constitution of the United States, is his right, the most stringent laws should be enforced to preserve the purity of the supply of drinking-water; or, if the settlements on the area are too valuable to be destroyed, a new source of supply should be obtained and guarded.

The protection of the citizen requires that every advantage be taken of our knowledge of the natural history of the typhoid infection, that it may be destroyed before reaching any of our water-courses. It is well enough to insist upon the purification of sewage by processes of precipitation, filtration, or irrigation before its water is delivered into the natural courses, for thereby the latter will be prevented from falling into the condition of open sewers, which is the lot of so many small streams in well peopled districts; but these processes can not be depended upon to remove the typhoid infection. This infection passes from the patient to our surface-waters directly by the sewers, or it drains through the soil with the subsoil-water, and reaches the surface on some lower level. Of course in either case it may be lost in the mass of water in which it is diffused, but it was not so lost at Plymouth nor at Lauzen. To protect the citizen and stamp out this fever, it should be made the duty of every medical man who attends a case of fever to see that the excreta are disinfected before being consigned to the sink, cesspool, or sewers, and the utmost care in this regard should be taken in cases occurring on a water-shed which is utilized for a public supply. So far as our knowledge goes, sewage would be deprived of that which, under ordinary conditions, constitutes its only danger-

ous element, were this system of bed-room disinfection efficiently practised.

Local authorities, such as water companies and boards, citizens' committees, health boards, and commissioners, should exercise a jealous guard over the public water-supply; but in many instances these would be powerless without the intervention and co-operation of the authorities of the state. Massachusetts, Illinois, and Minnesota have already taken steps in this direction. In the first mentioned state the board of health is invested with the general supervision of the water-supplies. No sewage, drainage, excrement, or other refuse or polluting matter of such kind or amount as —either by itself or in connection with other matter—will corrupt or impair the purity of a water used for domestic purposes, is permitted to be delivered into a water-course or any of its feeders within twenty miles above the point where a water-supply is taken. Upon the application of a city or town to the supreme court, alleging the pollution of its water-supply in violation of law, an injunction may be issued, or the polluting substances required to be so cleaned or purified that they shall no longer be deleterious. The limit of twenty miles in this law is a defect, but sanitary legislation is a thing of slow progress, and our friends in Massachussets undoubtedly secured as much as was possible for them to obtain at the time.

The board is required to examine the waters from time to time, for the purpose of ascertaining whether they are adapted for use as domestic water-supplies, or are likely to impair the interests or imperil the health of the public. It is required to conduct experiments to determine the best practicable methods of purification, of drainage, and of the disposal of refuse, and to recommend measures for the preservation of the purity of the waters. Moreover, it is the legally constituted adviser of cities, towns, corporations, firms, or individuals, in matters pertaining to the introduction of water-supplies or sewerage systems, making use of its knowledge and facilities on their behalf in regard to source and quality of water and methods of sewage disposal, having regard to the present and prospective needs and interests of other communities or individuals that might be affected thereby. The approval of the board is a legal requirement to the consideration by the legislature of any application for authority to introduce any system of water-supply or sewerage.

The board is also empowered to consult with and advise those engaged, or intending to engage, in any manufacturing or other business as to the best practicable method of intercepting, purifying, or disposing of any drainage or refuse that might result from the business to the detriment of the waters of the state. It is required to bring to the notice of the attorney-general all instances which may come to its knowledge of omission to comply with existing laws respecting the pollution of water-supplies and inland waters, and to report to the legislature any specific cases not covered by the provisions of existing laws which, in its opinion, call for further legislation. Finally, and very materially, the board is provided with funds to sustain the corps of engineers, chemists, and inspectors, whose labors are needful to the proper performance of its duties.

The report of the board's proceedings under these heads, submitted to the legislature in January of this year, shows the excellent work that may be accomplished in this way. Eleven applications from cities and towns for advice concerning water-supplies were received; eleven for advice concerning sewerage; two soliciting action to prevent the contamination of particular water-supplies; and one from a manufacturer for advice concerning the disposal of drainage from certain works, which he purposed establishing. The important question of a water-supply for the cities of Boston, Chelsea and Somerville, and the town of Everett, was one of those that came before the board. There are 123 sources of public water-supply in the state; but over 200 samples are investigated chemically and biologically every month, the samples being from rivers, ponds, and other sources that may be utilized in the future. Experiments are also in progress on methods of sewage-disposal, which will add considerably to our knowlege of the results which may be obtained in that direction.

With the aid of the state, the local authorities in their efforts to obtain and preserve a wholesome water-supply would experience no difficulty that could not be overcome by the expenditure of the necessary funds. The twenty-mile limit will in progress of time be blotted out, and the waters of the state be sharply divided into those which may be used as sources of domestic supply and those which carry off the waste water. The water-supply and sewerage systems of the state—of the country—should be as distinct as those

of every household, and the sooner this is accomplished the sooner will the rates of sickness and death be decreased among our people.

Your committee, therefore, urge a livelier interest in this important matter on the part of State Boards of Health, an interest which is not satisfied with discussing and subscribing to sanitary views of the subject, but which will leave nothing undone that will tend to invest them with power to act for the preservation of the public health. With all our boards operating, each within its domain, there would be no need of a committee of this Association to investigate the subject of water-pollution. In concluding, we submit the following resolution:

Resolved, That it is the well considered belief of this ASSOCIATION that it is an imperative necessity, especially in the more populous states, that state legislatures should give their boards of health that financial support which would enable them to act intelligently on all questions pertaining to the public water-supplies, investing them at the same time with the supervision of the said supplies, and with power to preserve these waters from contamination by sewage or other injurious matters.

CHARLES SMART.
S. W. ABBOTT.
G. C. ASHMUN.
W. W. DANIELLS.
EDWARD PLAYTER.

Various Sanitary Topics.

BY THE SECRETARY.

CONSUMPTION AS AN INFECTIOUS DISEASE.

This subject was taken up in the second annual report, but its importance justifies its consideration again and again, especially in the light of newer observations or experimental work. It has been estimated by competent authorities that from one-seventh to one-sixth of the human race die of consumption (tuberculosis). We have no vital statistics in Maine, therefore it is impossible to know the mortality from this disease in our State. Turning, however, to the records of our nearest neighbor, New Hampshire, we find that one eighth of the whole number of deaths for the year 1887 was caused by consumption, while diphtheria, scarlet fever, typhoid fever and small-pox combined caused only one eighteenth of the total mortality; it is customary now-a-days for heads of departments of vital statistics to represent graphically the comparative mortality from different diseases; and yet the death-rate from this disease is lighter in New Hampshire than in most of the New England and northern States. In Maine, undoubtedly, the phthisical death-rate would be found nearly like that of New Hampshire, not excessive as compared with other States, but as compared with the other causes of disease, it is still the insidious, terrible destroyer,—the scourge of scourges.

This terrible contribution to the death-rates, we have made with a resignation born of a belief that it is the inevitable price of our civilization, yet there are strong reasons, some old and some resulting from later investigations, for believing that pulmonary consumption (phthisis, pulmonary tuberculosis) belongs to the class of preventable diseases, and that an important line of prophylactic

work is in the teaching of the fact that consumption is an infectious disease, and that the observance of a few simple precautions would undoubtedly notably diminish its prevalence.

The following are some of the steps through which the belief in the infectiousness of consumption has come to assume the aspect of a scientific truth:

1. Observations of physicians and others, at various times and in various places, had led some physicians and the people generally in some countries to have a belief, vague or otherwise, that consumption is infectious.

2. A parallel line of studies on animal tuberculosis had inclined many veterinarians and others to a belief in its contagiousness and in its identity with human tuberculosis.

3. Inoculation experiments have shown that the disease may easily be communicated in this way, whether the tuberculous matter used comes from an animal or a human source, and that the disease is the same in either case.

4. Feeding experiments, in which the products of human or animal tubercular diseases were fed resulted in communicating tuberculosis to some of the animals subjected to the experiments.

5. Animals subjected to the inhalation of a fine spray containing the expectoration of consumptives, become tuberculous.

6. The discovery of Koch shows us that the *bacillus tuberculosis* is present in all forms of tuberculous disease, both human and animal.

7. That the bacillus of tuberculosis may be isolated from the pathological material in which it is formed and cultivated upon artificial media, as sterilized nutrient gelatine or potato, and though the cultures are carried to many generations, the artificially cultivated bacillus loses none of its virulence when inoculated into animals, or given to them by inhalation.

8. Animals thus inoculated with the pure cultures of the bacillus, or subjected to inhalation experiments with it, develop tuberculosis, and the bacillus is found in the diseased organs of the experimental animals, still capable of re-infection when inoculated, or of re-cultivation artificially.

TO WHAT DEGREE IS HUMAN CONSUMPTION COMMUNICABLE?

This question does not admit of being answered by a strictly numerical statement for various reasons, some of which may be

inferred at a later point in this paper. With medical authorities there is far from being a unanimity in the estimation of the danger of permitting well persons to come into prolonged and close association with consumptive patients, as in home life, in schools, in hospitals, prisons, etc. Some, though, admitting the infectious nature of pulmonary tuberculosis, claim that the actual danger of the communication of the disease from the sick to the well is very slight indeed. Others believe that there exists a very grave danger in unguarded intercourse with consumptives, and that the large prevalence of consumption is due principally to the communication of the infection (the bacillus) from the sick to the well. The non-contagionists adduce the records of certain hospitals exclusively devoted to the care and treatment of consumption, in which no evidence of the contagiousness of consumption can be gathered from the history of the attending *personnel*. One of the most striking pieces of negative evidence of this kind is that which is presented by the Brompton Hospital, England, in which many thousands of patients have been treated, and in which for over thirty years it is claimed there has been no undoubted case of infection among the attending physicians and a very low percentage of cases of phthisis among the attendants and nurses.

On the other hand, the contagionists claim that in a well regulated hospital for this class of diseases, the liability to the spread of the infection would be very slight indeed, and would be much greater under the conditions of private life. They claim also that observations which apparently indicate communicability occur too frequently, and are sometimes of too striking a character to admit of their explanation as coincidences.

IS THE BREATH OF THE CONSUMPTIVE PATIENT INFECTIOUS?

Tappeiner, to determine the question whether the breath of consumptives is infectious or not, had a patient in the latter stages of consumption cough every time she coughed into a small box in which two rabbits were confined. The animals were subjected to this treatment for two months, but in spite of it they remained entirely well.*

Bollinger has sought to determine this question by passing the expired tuberculous breath over a surface moistened with glycerine,

*Zeitschrift fur Hygiene. Vol. V, p. 282.

in which he endeavored to find the bacillus, but was unable to do so, whence he concluded that the infection is not communicated by the breath.*

In some recent experiments Grancher convinced himself of the non-infectiousness of the breath of consumptives, by letting patients with this disease breathe into a large rubber sack in which guinea pigs were kept. In this way the animals were treated for six weeks, and, though kept under observation for several months afterwards, no trace of tuberculosis showed itself in them.†

Cadeac and Mallet employed the same experimental way of settling this question, using rabbits instead of guinea pigs, and were not able to produce tuberculosis in the animals in this way, even when an artificial bronchial catarrh had been previously induced. They also subjected the animals to inoculation with the water of condensation obtained by the cooling of the air expired from patients in the cavernous stage of phthisis, but this proved to be equally inoffensive.‡

We may accept the conclusions therefore of MM. Cadeac and Mallet as undoubtedly correct that the air in leaving the bronchial tubes of a phthisical patient is purified of all its infective elements, as air is freed from all its particles of dust by being passed through a chamber, the sides of which are moistened with glycerine, according to the method of Tyndall in his optical examinations of the atmosphere.

HOW CONSUMPTION IS USUALLY COMMUNICATED.

When in 1882 Dr. Robert Koch modestly told the Physiological Society of Berlin that he had found the specific cause of tuberculosis, he had already proved that the bacillus tuberculosis is to be found nearly always, if not invariably, in the sputum of consumptive patients and that the bacillus stands in an etiological relation to cases of pulmonary tuberculosis, instead of itself being the results rather than the cause of the disease, as was for a time assumed by many during the brief period of incredulity which followed.

In regard to the constancy of the presence of the infective bacillus in the expectoration of consumptives, Koch himself says: "The first investigations which I made with tuberculous sputum showed that

* Uffelmann's Supplement, 1883, p. 133.

†Centralblatt fur Bakteriologie und Parasitenkunde, Vol. V, p. 289.

‡Revue D'Hygiene, Vol. X, p. 255.

the bacillus was abundant in about one-half the cases. In other cases only a few bacilli were to be found and in many they appeared to be entirely wanting. But, since I came to use Ehrlich's method of staining and have acquired a greater experience, I have not failed in a single instance to find the bacillus, though the cases which have come under my observation have not been insignificant in number."*

As early as the following year (1883) numerous investigations had confirmed the truth of Koch's observations. Fräntzel said that the bacillus was invariably found in the expectoration of 380 cases of pulmonary consumption, and Kowalski, examining 6000 preparations of the sputa from 600 patients did not find the bacillus in a single case other than in cases of consumption.† Similar testimony, even as early, was given by Cheyne, West, Lichtheim, Zichl, Kredel, Demme, Pfeiffer, and many others.

The inhalation experiments of Koch were made with pure cultures of the bacillus, which were originally taken from a phthisical human lung, but which during a period of fifteen months had been carried through twenty-three cultivations on artificial media. Rabbits, guinea pigs, rats and mice were kept in roomy cages in a garden and subjected for three successive days to half-hourly inhalations of the bacillus, which was prepared by rubbing the pure culture in distilled water and diluting it until a nearly colorless fluid was obtained. Collectively, the rabbits and guinea pigs all became tuberculous notwithstanding their healthful surroundings, and the same is true of the rats and mice, although these animals are known to be far less susceptible to tuberculosis than others.

Later observations have made it pretty evident that consumption is in a large proportion of cases an acquired rather than a hereditary disease, and that its acquisition is almost exclusively by the inhalation of the dried and pulverized tuberculous sputum.

The opinion of Koch on this matter is expressed as follows:

In regard to the way in which the tubercle virus is communicated from the consumptive patient to the well, there can be no doubt. During attacks of coughing, particles of the viscid sputum are ejected into the air and, to a certain extent, atomized. Now numerous experiments have taught that the inhalation of atomized tubercular sputum makes animals tuberculous with absolute certainty, not only those which are very susceptible to tuberculosis, but also those which are usually immune. That man in this respect is an exception is not to be assumed. When, therefore, accidentally,

*Mitcheilumgen ans dem.Kaiserl, Gessundheitsantc, Vol. II. p. 32.

†Uffelmann's Supplement, 1883.

a healthy person inhales a particle of sputum freshly expectorated, we may presume that he may become infected. Yet infection will not often occur in this manner because the particles of sputum are not so small that they can remain suspended in the air. Far more likely to produce infection is the dried sputum, which on account of the careless way with which the expectoration of consumptives is cared for, evidently gets into the air in considerable quantities. Not only is the sputum expectorated directly upon the floor in some cases, there to be dried, trodden upon and to be swept into the air in the form of a powder, but the clothing and the coverings of the bed and the pocket handkerchief are soiled with the infectious material, and, drying, becomes pulverized.*

The French writers on this subject are generally in accord with Koch, and Dr. Richard, in a paper read before the *Societe de Medicine Publique* three years ago, draws the following vivid picture of the danger from the infectious tubercular dust:

The expectoration begins to be really dangerous when in the effort of coughing, through awkwardness or heedlessness, it is projected upon the bed, the clothing, the bed clothes, the walls, the floor, or when it is received in the handkerchief. Then rapidly drying, it becomes friable, is pulverized and disseminated, and henceforth the atmosphere of the room may be considered as virulent for a long time. The sputum falling on the bedding, the mattress, sheets, blankets, or on the handkerchief, once dry, is detached at each movement of the patient, and especially when the bed is made, it goes to rejoin that portion which has been launched directly upon the floor, and that which, after dessication, has fallen from the walls. All is trampled under foot and is reduced to a powder finer and finer. This infectious powder goes and comes; the currents of air, the frolics of children, the strokes of the broom raise it and make it float in the air where it remains suspended for a while to finally fall on the bed, the furniture, the walls, the floor. That part which is taken up by the bed is the most stable, the woolen blanket or coverlid is like a sponge which stores up the powder with a prodigious facility; that of the furniture and walls is displaced often, and each time it is raised a new portion goes to increase the store which is in reserve in the blankets, which finally may be considered as the natural reservoir of all the powder in the apartment.†

That this dust which floats in the chambers of consumptive patients retains its virulence for some time, we way infer from the results of experimental work which has been done in various quarters.

Schill and Fischer in one experiment in inoculating the sputum of a consumptive patient which had been dried 95 days produced tuber-

*Mittherlungen a. d. Kaiserl. Gesundheitsamte, Vol. II, p. 79.
†Revue D' Hygiene, Vol. VIII, 308.

culosis in all the animals used, and again, after the sputum had been dried 126 days, all the animals became tuberculous. After drying 186 days, one out of three animals became tuberculous, and after 226 days, all the inoculated animals remained well.*

M. Galtier states that tuberculous virus possesses such powers of resistance that it retains its activity in water, in putrified matter, on the surface of objects, in spite of dessication, of variations of temperature, and even of congelation.†

Sormani, in his studies on the vitality of the bacillus of tuberculosis, took the fresh sputum of a consumptive, some of which he dried upon linen and on glass and some of which he placed in water. That upon linen and glass he allowed to dry at a moderate temperature, and used it at later periods for inoculation. The watery mixture he used for direct injection into the animals. The result was that all of the inoculations made with the sputum which was less than eight weeks old produced tuberculosis with absolute certainty. Thus, tuberculous sputum whether moist or dry invariably retains its virulence for at least two months. It may also be mentioned as of interest that the sediment in the watery solution retained its infectiousness even to twelve months.‡

Dr. Pietro De Toma,§ an Italian physician near Lake Maggiore, found that the sputum, suitably dried, preserved its infectiousness for from nine to ten months, providing that it was kept removed from sources of humidity and at a medium temperature of 25° (77° F) and that when kept for more than two months at a temperature of from 30° to 35° (86° to 95° F.) it loses somewhat of its virulence.

All these opinions and investigations show that the bacillus of tuberculosis is capable of retaining its vitality when dried for a period quite prolonged.

Within the past few months two papers bearing upon our subject have been published by Dr. Georg Cornet, of the Hygiencic Institute of Berlin, and their importance entitles them to a translation in abstract at considerable length, viz: "The Distribution of Tubercle Bacilli outside the Body," and "The Death Rate and its Causes, among Nurses."

*Mitthiel, a. d. Kaiserl. Gesundheitsamte II, p. 133.
†An. Univ. Med. Sciences, Vol. 111, p. 390.
‡Uffelmann Supplement, 4th year, p. 146.
§Giorn. della Reale Societa Ital. D'igiene, Vol. ix, p. 375.

DISTRIBUTION OF TUBERCLE BACILLI OUTSIDE THE BODY.*

At the out start, the question was presented to me, where is the infection to be sought? Bearing in mind that consumption is by far the most widely distributed form of tuberculosis, that the lungs are the organs which show the most advanced changes, we are forced (irrespective of other reasons to which I shall refer in their appropriated places) to entertain the idea of a direct infection of these organs. As now, the lungs communicate with the outer world only through the medium of the air of respiration, we are compelled to regard this inspired air as the bearer of the virus. It would seem, therefore, at first, that the simplest way would be to examine the air by one or the other of the methods which are in use by bacteriologists, but the thought was forced upon me whether in the relatively small quantity of air (about 1000 litres, while man in quiet respiration breaths twelve times as much in a single day) which we examine, tubercle bacilli would,—I might say accidentally,—be found, even when the sample of air is taken from the immediate vicinity of the consumptive patient. Must not, moreover, the circumstance that many persons escape infection in spite of their constant association with consumptives, lead us to the conclusion that the air in all its parts can hardly be permeated in a great degree by the tubercle bacillus, as has generally been surmised, and as is expressed in the untenable hypothesis of the ubiquity of the tubercle bacillus.

If, then, the air itself is to be considered hardly a suitable object of our search, it would appear that the most appropriate direction for our investigation would be the examination of the corpscular elements of the air, the dust which has fallen by a natural process of sedimentation.

That the bacillus of tuberculosis, in spite of its minuteness, like all the other corpuscular elements of the atmosphere, obeys the law of gravity and settles to rest when the air is still, as by night, is made evident when we consider the fact that a mixture of pus in the much heavier element water, falls to the bottom of the glass after a while leaving the upper portions of the water entirely free from those bacilli which have no motion of their own.

For the purposes of the investigations, therefore, the dust was used which had settled naturally, care being had to take it from

*Zeitschieft fur Hygiene. Vol. v. p. 191 (Nov. 1888.)

those surfaces which were not liable to a direct pollution by the spitting or coughing of the patient, or by contact with fingers, cloths, utensils, or other objects. Preferably the dust was collected from the cross piece of the back of the head-board of the patient's bed, or from the wall back of the head-board, or sometimes from high hanging pictures, etc.

A small quantity of the dust collected with antiseptic precautions from the places indicated was intimately mixed with 15 ccm. of sterilzed bouillon and this divided into three parts and injected, 5 grm., into the peritoneal cavity of each of three guinea pigs.

An inoculation upon animals is absolutely necessary, for the tubercle bacilli, even in infected rooms, are scarcely in large enough numbers so that we could expect to find them by microscopic examination, for in each field of the microscope only an incomparably small quantity of the dust could be subjected to view. Furthermore there was a possibility that dust containing no tubercle bacilli, might still be infectious, its infectiousness being due to spores which we as yet have not been able to recognize as such. In this connection I am reminded of the well known observation, that the pus from a carious tuberculous vertebra, which, though showing no tubercle bacilli, proved itself infectious in an eminent degree by causing tuberculosis in animals when the pus was inoculated upon them.

In fact, in the later course of my investigations three samples of dust, which when injected into animals produced tuberculosis, showed not a single tubercle bacillus in a careful microscopic examination of a hundred preparations. Either I had not been able to fish out the baccilli from the dust, although they were present, or only spores were present.

As regards the practicability of discriminating between spontaneous tuberculosis and that produced by inoculations in experimental work of this kind, the author refers to the fact that among the many hundred guinea pigs and rabbits which Koch used in his work upon tuberculosis and anthrax, never one was found among the recently bought animals which was tuberculous, while recently, among the great number of animals which we have used during the past two years in the Hygienic Institute (of which I alone have used nearly a thousand) only three animals have been found with spontaneous tuberculosis, which always had its starting point in the

lungs. As I also made use of only newly bought animals, this source of error, is almost wholly removed.

A tuberculosis of an animal acquired in the stall or cage, almost without exception takes its starting point in the lungs, and is distinguishable, with absolute certainty, from the artificially-produced intra-peritoneal infection for at least forty or fifty days. In spontaneous tuberculosis, as we have said, the lungs are the organs which are affected, the bronchial glands are distinctly enlarged, but on the other hand, the abdominal organs are still entirely normal, or at the most show a few small tubercles in the spleen, while the omentum and the peritoneum are entirely free from tubercle.

Entirely different is the picture in intra-peritoneal infection. Here we find in the great omentum, before all else, several tubercular masses the size of peas or beans, caseated or softened, or, when a large quantity of the infectious material has been used, a thick sausage shaped formation is encountered. The spleen is more or less enlarged, oftentimes to six or eight times its normal size, and distributed through it are yellowish gray tubercles. The liver likewise is enlarged, dark red-brown or gray yellowish-brown showing numbers of small yellow collections of tubercle. The bronchial glands are normal or very slightly enlarged.

In all the experiments which follow, the possibility of confounding the tubercular growths with pseudo-tubercle was avoided by the demonstration of the bacillus tuberculosis.

As a preliminary experiment, a portion of dust about as large as a bean was taken from the ward of a hospital, sterilized and by means of a laparotomy introduced into the abdominal cavity of three guinea pigs. The wounds healed readily, and when, on the forty-fifth day the animals were killed, all their organs were found normal. On the peritoneum and omentum a few black spots were found, the remains of the dust, but nowhere a trace of tubercle.

Three other guinea pigs were treated exactly in the same way, excepting that after the sterilization of the dust, pulverized dried sputum which was rich in tubercle bacilli was added to it. Animal number one died of a peritonitis, due, undoubtedly, to other bacteria which were contained in the sputum. Animal number two died at the end of thirty-six days with tuberculosis of the abdominal organs. Animal number three was killed on the forty-second day and advanced tuberculosis of the abdominal organs was found.

The following and principal part of the experimental work was divided into the examination of the infectiousness of dust taken from hospitals where consumptive patients were treated, hospital wards where consumptives were not treated, insane hospitals, prisons, a room used for inhalation experiments with tuberculous material, private dwellings occupied by consumptive patients, polikliniks, orphan asylum, the lecture room of the Pathological Institute, surgical wards, streets, and public buildings.

(At this point more than forty pages are omitted which give a detailed description of the various experiments, and we introduce the following table which gives a summary of the results. A. G. Y.)

The sign x indicates that the animal when killed was found tuberculosis.

The sign — indicates that the animal when killed was found healthy, or that tuberculosis was absent.

The sign 0 indicates that the animal died of other diseases within a few days after the inoculation.

Table I.

HOSPITALS, INSANE ASYLUMS AND PRISONS

No.	Dust taken from.	Further Indication of Locality.	Result of Inoculation.		
		PRELIMINARY EXPERIMENT.			
		1 Sterilized dust, hospital No. 1...	-	-	-
		2 Sterilized dust, with dried sputum	0	x	x
		HOSPITAL No. 1.			
1	Consumptive ward A	Bedstead....................	x	x	x
2	" B	"	0	0	x
3	" C	"	0	0	0
4	" D	"	0	x	x
5	" E	Dust from Wardrobe	-	0	0
6	" D	Caught on glass, exposed 8 days.	-		
7	" E	" " " 8 " .	x		
8	" E	" " " 8 " .	-		
9	" D	" " " 14 " .	0		
10	" B	" " " 14 " .	0		
11	" C	" " " 14 " .	0		
12	" B	" " " 14 " .	0		
13	"	300 scm. of wall rubbed..	0	-	
14	"	Dust from linen bureau.........	0		
15	" F	Bedstead	0	0	x
		HOSPITAL No. 2.			
16	Ward..............	From cornice 2 m. high.........	0	0	0
17	"	" 2 m. "	0	-	
18	"	From cross piece of head-board..	-	-	
19	"	Dust from bed-clothes. Phthisis	0	0	
		HOSPITAL No. 3.			
20	Pavillion A.........	Bedsteads of consumptives......	0	0	0
21	" A.........	Wall rubbed, 2 sm	-	0	
22	" B.........	Bedsteads of consumptives......	0	0	-
23	" B.........	Wall rubbed, 2 sm.	-	-	
		HOSPITAL No. 4.			
24	Ward A............	Bedsteads (2 consumptives).....	0	x	-
25	" B............	" (8 ").....	0	0	-
26	" C & D.........	" (9 & 2 ").....	0	0	x
27	" E	" (7 ").....	0	0	x
28	" B & E.........	Wall rub'd, 6 sm—8 & 7 consumptives..................	0	-	-
29	" C & D.........	Wall rub'd, 5 sm—9 & 2 consumptives..................	-	-	x
		HOSPITAL No. 5.			
30	....	Wall back of bed. Phthisis	0	-	-
31	....	" "	0	-	x
		HOSPITAL No 6.			
32	Pavillion A.........	Auguste L. Bed and wall......	0	x	x
33	" B.........	Karl M. "	0	x	x
34	" C.........	Br. Wall	0	-	x
35	" D.........	Frau H. Wall and bed	0	0	x

Table I.—Concluded.

Hospitals, Insane Asylums and Prisons.

	Dust taken from.	Further Indication of Locality	Result of Inoculation.		
		Hospital No. 7.			
36	Ward A............	4 Consumptives. Bedstead.....	0	0	0
37	" A............	4 " Wall.........	0	0	0
38	" B............	1 Consumptive. Bedstead......	0	0	x
		Insane Asylum No. 1.			
39	....	Bedstead of deceas'd cons'mp'tive	x	-	-
40	....	" consumpt. attendant.	-	-	-
		Insane Asylum No. 2.			
41	Ward A...........	Wall and bedstead..............	0	-	-
42	" B............	3 Consumpt's. Wall and bedst'd	0	0	0
43	" C............	Consumptives. Wall	0	0	x
44	Room A............	Wall........................	0	-	-
45	" B............	"	0	-	-
		Insane Asylum No. 3.			
46	....	Living room. Consumptive.....	0	0	-
47	....	Patient who swallowed the sputum. Bedstead and wall.....	0	-	-
48	....	Wall of room rub'd, in which four w'ks before a consumpt. had died	0	0	0
49	....	Wall and bedstead. Consumptive who spit in handkerchief......	0	0	x
		Prison No. 1.			
50	....	Work-room. Two consumptives.	-	0	-
51	....	Jacket of consumptive..........	0	0	0
52	....	" "	0	-	
53	....	Wall of cell. Consumptive.....	-	-	-
		Prison No. 2.			
54	....	Dust from ventilation shaft.....	0	-	-
		Room for Inhalation Experiments with Tuberculous Material.			
55	....	Wall rubbed, 200 scm..........	x	x	
56	....	3 Metres from work table... ...	-	-	

Table II.—A.

PRIVATE CONSUMPTIVE PATIENTS.

Number.	Source of Dust.	Result of Inoculation.			Used spit-cup or not.	Spit in handkerchief or not.	Spit on floor or not.
57	Herr W.	0			Yes.	Yes.	
58	Herr H.	0					Yes.
59	Frl. Al., Hotel	x	0	0	"	"	Seldom.
	" " "	0	0				
60	Herr B.	x	x	–	"	"	
61	Albert B.	x	x	x	"	Seldom.	No.
62	Herr K	x	x		"	Yes.	Yes.
63	Herr B.	0	0	0	"	"	No.
64	Herr Louis M	0	x	x	"	"	Yes.
65	Frau P.	0	0	x	"	"	"
	" 6 weeks after death	0	x	x			
66	Frl B	x	x	x	"	"	
67	Herr P.	0	–	x	"	"	
68	Richard K	0	0	x	"	"	"
69	Frl Laura V., deceased	0	0	x	"	"	No.
70	Herr O	0	x	x	"		Seldom.
71	Hermann E.	0	0	x	No.		Yes.
72	Herr S.	0	x	x	Yes.	Very Seldom.	No.
73	Herr J.	0	–	x	"	No.	Seldom.
74	B. R	0	x	x	"	Yes.	Yes.
75	Frau K.	0	0	x	"	"	"
76	Frau W	0	x	x	"	"	No.
77	Heinrich B.	0	0	0	"	Frequently.	"
78	Anna F.	0	0	x	"	Yes.	"
79	Frau Sch	0	x	x	"	"	
80	Herr S.	0	0	x	"	Seldom.	No.
81	Fr. Auguste S.	0	0	0	"	Yes.	

Table II.—B.

PRIVATE CONSUMPTIVE PATIENTS.

Number.	Source of Dust.	Result of Inoculation.			Used spit-cup or not.	Spit in handkerchief or not.	Spit on floor or not.
82	Frau R.	0			Yes.	No.	No.
	"	–	0	0			
83	Frau St.	0			"	"	"
84	Herr H	0	0	0	"	"	"
	"	0	0	–			
85	Frau E	0	0	–	"	"	"
86	Herr H	0	0	0	"	"	"
	"	–	–	–			
87	Fr. Hulda R	–	–	–	"	"	"
88	Frau P.	0	–	0	"	"	"
	"	0	–				
89	Herr R.	–	0	0	"	"	"
90	Herr S., Engineer	0	–	–	"	"	"
91	"	–	–				
91	Herr L	0	–		"		
	"	0	–				
92	E	0	–		"	"	"
	E	0	–				
93	Frl. Minna K	0	–	–	"		"
94	Herr W	0	0	0	"	"	"
95	Fr Karolina L.	0	0	–	"	"	
96	Herr St	0	0	0	"	"	"
97	Frau Pr	0	0	0	"	"	"
98	Paul T	0	0	0	"	"	"
99	B., Letter carrier	0	0	0	"		"

Table II.—B.—(*Concluded*).

Number.	Source of Dust.	Result of Inoculation.			Used spit cup or not.	Spit in handkerchief or not.	Spit on floor or not.
100	Herr L..	0	0	-	Yes	No.	
101	Frau Bertha Sch	-	-	.	"	"	No.
102	Herr J.	0	0	-	"	"	"
103	Herr N	0	-	-	"	"	"
104	Richard K	0	-	-	"	"	
105	Herr St.	-	-	-	"	"	
106	Herr Chr. Adolf.	0	-	-	"	"	Yes.
107	Herr B	0	0	-	"	Frequently.	
108	Frl. M.	0	-	-	"	Yes	No.
109	Herr O	0	-	-	"	Frequently	"

Table III.

PLACES IN WHICH CONSUMPTIVES DID NOT HABITUALLY STAY.

	Dust Taken From.	Result of Inoculation.		
	POLIKLINIK B.			
110	Waiting room for house patients, 1 sm. wall	-	-	-
111	Inhalation room	-	0	-
	DR. LASSAR'S PRIVATE KLINIK.			
112	Room with 2 lupus patients. Bedstead and wall	0	-	
	ORPHAN ASYLUM.			
113	Sleeping room. Bedstead	0	-	
114	School room. Dust..	0	0	
115	" "	0	-	
116	Sleeping room, on 1 sm. wall rubbed	-	-	
	LECTURE ROOM OF PATHOLOGICAL INSTITUTE.			
117	Auditorum. Dust	0	0	
118	" 1½ sm. of wall rubbed	0	-	
	SURGICAL STATION OF HOSPITAL No. 1.			
119	Pavillion A. Bedstead and cornice rubbed	-	0	-
120	Ward B. Bedstead and cornice rubbed	-		
	STREETS, PUBLIC BUILDINGS, ETC.			
121	Roof of Hygienic Museum	-	-	-
122	" " "	-	-	
123	Stair-case of the Hygienic Institute	-	-	
124	Colonnade on Konigstrasse	0	0	-
125	" "	0	0	
126	Konigstrasse, Court House and Post Office	0	0	0
127	" House Nos. 47 and 62	0	0	-
128	" House Nos. 39, 40, etc	0	-	-
129	"	0	0	-
130	Friedrichstr, No. 108, 111, 112	-	-	-
131	" No. 131, 132	0	-	-
132	Chausseestrasse	0	0	-
133	My work place in the Hygienic Institute	0	-	-
134	" " " " "	-	-	-

a. Among the thirty-eight samples of dust taken from the hospital wards in which consumptive patients were treated, the dust was found entirely free from pathogenic bacteria only four times.

b. In the three insane hospitals among eleven samples, it was free from them once.

c. In the two prisons, among five samples, once.

d. Among sixty-two samples from private houses where consumptives patients resided, only five times.

e. In the polikliniks, orphan asylums, etc., among twelve samples, two times.

f. In surgical halls, among three samples, two times.

g. On the street, etc., among fourteen samples, it was free five times.

The following tabulation shows the comparative danger of the dust from different places to the inoculated animals.

Numbers.	Places from which samples of dust were taken.	Number of inoculated animals.	Died of		Died of infectious diseases.		Remained well.
			Tuberculosis.	Other diseases.	Total.	Percentage of inoculated animals.	
1	In the seven hospitals..............	94	20	52	72	76.6	22
2	In the three insane asylums.	33	3	16	19	57.5	14
3	In two prisons.....................	14	0	6	6	42.0	8
4	Inhalation experiment room.........	4	2	0	2	50.0	2
5	Private patients	170	34	91	125	73.5	25
6	Poliklinik, orphan asylum, etc.......	28	0	14	14	50.0	14
7	Surgical halls.....................	8	0	1	1	12.5	7
8	Streets and hygienic institute........	41	0	16	16	39.0	25
9	Streets alone........................					55.0	
	Totals	392	59	196	255	65.05	137

From this table we can make the deduction that the danger to the inoculated animals of the tubercle bacillus was in the hospitals 47.6 per cent, in the insane asylums 17.6, and in private dwelling houses of consumptive patients 43.6.

Considering the danger which came from micro-organisms as a whole, well arranged surgical wards seem to be more free from danger than any other places, freer even than in the open air, and that the most danger came to the inoculated animals from the dust of the medical wards. Thus the danger was in the proportion of 12.5 to 76.6.

As regards the danger from the tubercle bacillus, we see that, from twenty-one consumptive wards in seven hospitals, the dust from fifteen proved to be virulent, that is, to contain the bacillus of tuberculosis.

A cursory glance at Table II, A and B shows us that, invariably, where the tubercle bacillus was found, the patients did not restrict themselves to the use of the spit-cup, but expectorated also upon the floor or into the pocket handkerchief; while I succeeded only in a single instance in making an animal tuberculous where the patients had surely restricted themselves to the use of the spit-cup.

We may, therefore, from this, get a solution of the riddle, why in one family all of the members, one after the other, go down with consumption, while in other families, the disease remains restricted to a single case.

Even with only a cursory glance over the foregoing tables one fact comes prominently into the foreground, that the presence of the bacillus of tuberculosis has often enough been found in rooms and places where consumptive patients stay, while in other places where persons with this disease do not habitually stay, it has not been found; in fact, from the inoculation of the 29 samples of dust upon 873 animal which is recorded in table III, not a single animal became tuberculous, results very different from those which would have been looked for by the adherents to the theory of the ubiquity of the tubercle bacillus.

We must bear in mind that the bacilli are comparatively heavy bodies which sink even in water or pus, and much more rapidly in air. We may imagine an uncleanly patient in the centre of a circle of infection, from which central point the bacilli are dissipated into the air in all directions, but of course the farther we go from the patient the more sparsely are they sown. It is a fact, grounded by Koch and confirmed by subsequent investigators, that the tubercle bacillus can never undergo development independently of animal organisms, can never multiply in the outer world as can most other forms of bacteria on almost every possible form of culture fields.

In addition to its fastidiousness as to its pabulum, its growth in the outside world is prohibited by its necessity for a steady temperature equalling that of the higher animals.

Thus the growth of the tubercle bacillus outside the animal body is absolutely out of the question, a fact for etiology and phophylaxis of the highest significance.

All the tubercle bacilli which infect man or animals must therefore have previously lived in a human or animal organism, and, leaving these, have directly or indirectly been communicated to their new hosts, probably the most frequently through the medium of the air.

How, therefore, and under what conditions, does the tubercle bacillus leave the human or animal organism?

By far the most frequent source of infection for man is without doubt the tuberculosis of man himself, and especially that form, consumption, in which the disease is exerting its destructive processes upon the lungs. Remembering that one-seventh of all human beings die of phthisis, and that the most of these patients, for weeks and months, and often for years, expectorate vast numbers of bacilli which become free in the outer world, we cannot wonder at the frequent opportunities for infection.

The question occurs therefore, how does the tubercle bacillus, which is produced in the lungs, become communicated to the atmosphere? Is it only the sputum which communicates it, or is it liberated also in the expired air? From the point of view of prophylaxis this is by far the most important question, for on its answer alone hangs the possibility of whether we can protect ourselves against tuberculosis, whether we can restrict the disease, or whether we must, with fettered hands surrender ourselves to it. If not only the sputum but the air which has been breathed out, or which has swept across tuberculous masses, brings the tubercle bacillus, then nothing remains but to resign ourselves and await with folded hands until fate brings us the disease through an infected inspiration. Then that fatalism, which even at the present time reigns too much in public health matters, would have its justification, for where is the place where no consumptive can be found who would be liable to infect us with his breath? Horrible then would be the thought to each sufferer with this disease that he, with every breath, poisons the air which surrounds him, his attendants,

and his family. A consciousness of such a fact would loosen the ties of the family and of society.

Fortunately, it is otherwise.

We must regard it as an absolutely established fact that never and under no circumstances can bacilli or their spores be taken up from moist surfaces by evaporation,or by the air which is wafted over them. Nägeli has shown by a series of investigations which are beyond cavil that this is a fact.

As regards evaporation, we must consequently remember that we have not to do with volatile contagia, nor with gaseous miasmata, but with corpuscular elements which are subject to the laws of gravity, of adhesion and of cohesion. Thereby is the fact explained that when many persons breathe the same infected air, one is infected and the other is not, on account of the uneven distribution of these corpuscular elements.

The former view that the almost infinitesimal body suspended in fluids were evaporated, taken up with the molecules of water and remained suspended in the atmosphere, is erroneous. The simple laws of physics are against it. It is well known that in the evaporation, at ordinary temperatures, of a watery solution of sugar or of common salt, the sugar or the salt all remains behind. Of these substances not the smallest particle is lost by evaporation. How, then, can we conceive that bacteria and other micro-organisms can be raised in the process of evaporation, for the lightest among them are many million times larger and heavier than are molecules of sugar or of salt.

Bacteria can be taken up and transported from the surface of fluids or moist substances only by mechanical action as might occur by the bursting of bubbles in the process of boiling or by the breaking of the spray from the waves during a storm.

(The author here refers to the experiments of many investigators which show quite conclusively that the atmosphere of the consumptive's room is not directly infected by the breathing of the patient even during violent attacks of coughing. A. G. Y.)

So we may regard it as an indisputable fact that the breath of expiration can never under any circumstances contain tubercle bacilli or their spores, and that there is no danger of the communication of the bacilli to the atmosphere, so long as the sputum is moist.

It is true that small particles of sputum containing bacilli may be thrown into the air in violent attacks of coughing, but the danger

from this source, as has been shown by reference to the foregoing experiments, is very slight indeed. During attacks of coughing, even the bacilli are caught upon the moist surfaces of the respiratory canal, the soft palate and teeth. By far the most frequently the bacilli are communicated to the air by the drying and pulverization of the sputum and this is practically the only source of infection which we have to guard against.

Let us for a moment consider as regards its possibilities of drying and pulverization, what becomes of the expectoration which we have to regard as the death-cause of one-seventh of all human beings.

If the patient is at home he expectorates in his spittoon containing water or other fluid which can be emptied now and then into the house drainage system. In this way drying, pulverization and infection are out of the question.

Or the sputum is discharged into a vessel filled with sand or sawdust. In this case we have to reckon upon the chances of a subsequent drying and ærial diffusion of the pulverized sputum.

Or the patient simply spits upon the floor which is bare or covered with carpet or rugs, a practice which one finds now and then even among the tolerably well-to-do class of whom we should expect something better. In this case by constant trampling beneath the feet the dried sputum is pulverized into a powder finer and finer, yet in spite of this probably but a small part of it is reduced into so impalpable a powder that it is capable of being suspended for any length of time in the atmosphere.

In addition to the spittoon and the floor we have to consider the pocket handkerchief as an object which receives the expectoration.

Wernich has shown that porous bodies which contain bacteria part with the germ even with a very moderate movement of air through them.

I can think of no condition more favorable for a rapid evaporation of moisture and a speedy drying of the sputum than that of the pocket handkerchief kept in the pocket at the temperature of from 25° to 35° (77° to 95° F.) In addition to this it is subjected to a constant and unavoidable rubbing in the pocket, and particularly when it is used, the pulverized dust is diffused into the atmosphere and others are in danger of being infected, and the patient himself is continually subjected to re-infection.

What is said here of the handkerchief will apply also to the soiling of other clothing or cloths with the sputum. If the handkerchief is used merely for wiping the mouth the danger is very much lessened particularly so for the reason that the remainder of the sputum which clings to the lips is mostly free from bacteria, being composed mostly of the salivary secretions.

Indoors, therefore, we have practically only the danger to guard against which comes from spitting in the handkerchief and upon the floor.

(The author refers to the possibility of infection from breathing the dust of the street which, it is conceivable, may sometimes contain infectious sputum-dust, and he adduces some statistical and other investigations made among the street sweepers of Berlin from which he concludes that the danger of this outdoor tubercular infection is very slight indeed. A. G. Y.)

PREVENTIVE MEASURES.

The first fact to be kept in mind is that the consumptive patient is, of himself, almost absolutely free from danger to those around him, and that he becomes dangerous only because of his indiscreet habits. The patient should be taught that if he becomes a danger, he will be a far greater danger to himself than to anybody else. As, once in a prison, I expressed surprise that the patients were permitted the use of a light in their cells on account of the danger of the malicious burning of the prison, the superintendent answered that "in that direction you may have no fear, for the prisoners will be careful for they know too well that, if they kindle anything, they themselves would be the first to burn before we could help them." Is it otherwise with consumptives?

It is indeed clear that the consumptive, being placed in the center of the little cloud of dust which contains the bacillus, is subjected to the inhalation of more of this stuff than anybody else. Of the cleanly and discreet patient I do not here speak, for he is not subjected to the inhalation of the dust of his own sputum. With the uncleanly, much depends upon the quantity of the expectoration; if much is produced, much is dried, pulverized and dissipated, and therefore, much is inhaled.

The first consideration in the way of prophylaxis is to avoid the drying of the sputum. The patient should, when he is at home,

never and under no circumstances spit on the floor or in his handkerchief, but in a spit-cup. Observing this precaution, he may be assured that, if he strictly holds to it, he will neither endanger himself nor anybody else.

As regards the choice of the spit-cup, the author recommends one provided with a handle so that it can be carried near the mouth and used, and thinks it preferable for it to have a cover, not so much to prevent the evaporation of its contents as to avoid the possibility of the distribution of the bacilli by the means of flies.

The patient should avoid endangering his family by kissing. He should also avoid bringing articles to his mouth which later may be carried to the mouths of other persons, as, for instance, placing the trumpets or other playthings of children to his own mouth.

The glasses, spoons, etc , which he has used should be carefully cleansed in boiling water before being used by other persons. According to the experiments which have hitherto been made, the perspiration of the tuberculous patient is to be regarded as free from danger, yet the patient's linen should be kept separate as far as possible from the rest of the washing. Pocket handkerchiefs and shirts should be thoroughly boiled during the process of washing.

If a death has occurred from consumption, a thorough cleansing should be made of the room which he has occupied. First the bed and its coverings, sofa cushions, carpets, curtains, and clothing of the patient should be disinfected in an apparatus by the use of streaming steam. (Steam not under pressure, but flowing freely through the articles.)

In the paper of which the foregoing is an abstract Dr. Cornet examines the question from the point of view of the bacteriologist or experimentalist; in the following work, he studies the subject of the communicability of consumption from its statistical aspect.

THE DEATH RATE AND ITS CAUSES AMONG NURSES.*

By the co-operation of the proper governmental authorities Dr. Cornet was enabled to get trustworthy statistics upon which he bases the present study. The figures of the Imperial Statistical Bureau show that for the year 1885 there were 11,048 persons in Prussia who were engaged in the care of the sick. He found it necessary to exclude from his study all but the Catholic orders of

*Zeitschelft fur Hygiene, Vol. vi. p. 65 (Apr. 1889.)

Sisters of Mercy and similar orders of male nurses for the reason that, with the others, their term of service is not for life; they were liable at any time to change their work or to marry.

Among the orders which he retains for purposes of study, the members upon admission are bound by a solemn oath to remain in the order during life, and, neither on account of sickness, nor for any other reason, are they able to leave it.

After sifting the statistical material in his hands to eliminate as far as possible chances of error, he retained the histories of thirty-eight cloisters including a yearly average of 4,028.8 members, and, if it might be objected that this somewhat limited number failed to give sufficient breadth of observation, it might be said that its depth compensated, for the histories extended over a period of twenty-five years for each cloister, giving the number of deaths, the causes of death, age, and length of time the deceased had been a member of the order, the duration of the disease and the kind of work which was done by the deceased.

Table I gives a view of the number of deaths from all the principal causes for thirty-eight different orders or cloisters which are represented. Of the total number of 2,099 deaths, there were from tuberculosis, 1320; from typhus and typhoid fever, 177; from small-pox, 20: from cholera, 17; from erysipelas 9; etc. The percentage of deaths from tuberculosis was 62.88.

A glance at the table (omitted, see Table III) shows that the grouping of the causes of death as regards their numerical relations to each other is entirely different from what we usually find. Ordinarily, the deaths from tuberculosis stand in the relation to the deaths from all other causes as one-seventh to one-fifth, but this table shows that among these nurses nearly two-thirds of the total number of deaths occur from tuberculosis, while among some orders it is as much as three-fourths of the total number of deaths

Table II shows the number of deaths which have occurred in each order from tuberculosis and from all other diseases at the different quinquennial periods from fifteen to seventy years of age. The following abstract of the table which he gives shows only the total for the different periods.

Abstract of Table II giving totals of 40 Orders or Cloisters.

From 15 to 20 yrs.		From 20 to 25 yrs.		From 25 to 30 yrs.		From 30 to 40 yrs.		From 40 to 50 yrs.		From 50 to 60 yrs.		From 60 to70yrs.		Over 70 years.			
Died of Tuberculosis.	Of Other Diseases.	Tuberculosis.	Other Diseases.	Tuberculosis.	Other Diseases.	Tuberculosis.	Other Diseases.	Tuberculosis.	Other Diseases.	Tuberculosis.	Other Diseases.	Tuberculosis.	Other Diseases.	Tuberculosis.	Other Diseases.	Total Deaths	Mean Age at Death.
14	9	164	79	348	124	525	186	201	146	43	107	19	81	6	47	2261	36.27
23		243		472		711		347		150		100		53		-	.

Turning our attention to table II we see that by far the greatest number of deaths have occurred between the twentieth and fiftieth years of life, and that the largest number occurs between the twentieth and fortieth years. During the next period of five years the deaths have sunk to about one-half of those between 30 and 40 while in the statistics for the whole nation the death-rate rises until the seventieth year. The explanation of this fact is not that the nurses have acquired an immunity, but largely in the fact that the swelling of the death-rate in the earlier years leaves only a few persons who reach middle or advanced life.

The small number of deaths in the period from fifteen to twenty years of age has its explanation in the fact that but few persons enter the orders at so early an age, seventeen years being the minimum age at which they are received. It will be seen also by the table that the average age of the descendent has been only 36.27 years, a number so low that its significance makes further comment almost superfluous.

We must say, however, that this death-rate has occurred, not among persons recruited from the physically weak, but that it has occurred among strong and healthy young men and women who have entered the order mostly between the ages of twenty-five and thirty or thirty-five and not until their physical fitness has been attested by a physician, insuring, therefore, an average physical

soundness above that of the general population at the same ages of life. In some of the orders, this average age is not reached, but the local average has been as low as 28 or 30 years.

There is hardly any other group of people among whom we find so short an average life,—so rapid a dying.

Seeking now the cause for this excessive mortality we find it by an examination of columns 4-11 of table II, for by a comparison of the deaths in these columns from consumption and from all other diseases during the years of life which are included, the deaths from tuberculosis not only exceed those from all other diseases, but are even five and seven times as great.

The death-rate among all these orders of nurses is extraordinarily great and the maximum mortality falls upon the periods of life from 20 to 50 years of age. The overruling cause of this consists in the dominating influence of tuberculosis.

Table III gives a summary of the deaths from the principal diseases at the various stages of life.

Table III.

	Causes of Death.	No. of deaths at various ages from causes as given below. From 15 to 20 years.	From 20 to 25 years	From 25 to 30 years.	From 30 to 40 years.	From 40 to 50 years.	From 50 to 60 years.	From 60 to 70 years.	Over 70 years.	Total.
1	Tuberculosis	14	164	348	525	201	43	19	6	1320
2	Typhus and typhoid fever	5	41	54	47	19	10	1	-	177
3	Small-pox	-	2	8	6	3	-	1	-	20
4	Cholera	-	2	6	7	1	1	-	-	17
5	Erysipelas	-	1	3	2	2	1	-	-	9
6	Cancer	-	-	2	12	15	13	7	1	50
7	Dropsy	-	1	2	11	9	13	12	6	54
8	Apoplexy	1	2	-	4	3	11	4	5	30
9	Inflammation of thoracic organs	1	2	11	14	14	8	16	8	74
10	Diseases of heart	1	7	8	18	20	11	10	2	77
11	Diseases of brain	-	3	1	11	8	2	1	1	27
12	Renal diseases	-	1	2	8	5	2	2	1	21
13	Diseases of abdominal organs	-		3	6	6	9	3	-	27
14	Old age and general debility	-	-	-	1	-	-	10	17	28
15	Other diseases	1	17	24	39	41	26	14	6	168
	Total deaths	23	243	472	711	347	150	100	53	2099

Abstract of Table IV., giving the mortality from Tuberculosis and Typhoid and Typhus Fevers only.

	Tuberculosis.		Typhus and Typhoid Fever.	
	Nation.	Nurses.	Nation.	Nurses.
Ages from 15 to 20	18.64	116.96	5.63	68.48
" " 20 to 25	29.99	137.36	5.95	40.33
" " 25 to 30	36.09	176.22	5.28	29.14
" " 30 to 40	41.87	142.11	5.18	13.72
" " 40 to 50	47.92	88.82	5.99	9.80
" " 50 to 60	66.12	47.31	7.65	15.14
" over 60	78.02	88.88	7.03	6.35

Table IV shows the mortality for each principal cause of death among each 10,000 living at each given age, comparing the death-rate of the general population at these given ages, with the death-rate of the nurses. As regards tuberculosis, the deaths at the period between fifteen and twenty years is in the whole nation 18.64 as compared with 116.96 for the nurses.

Comparing further therefore the nation with the cloisters, it is shown in the table in the original that the death-rate at the period of life from fifteen to twenty years in the cloisters exceeds that of the general population fourfold; from the twentieth to the thirtieth year about threefold; from the thirtieth to the fortieth year it is about twice as great. From this last period of life the death-rates become somewhere nearly equal.

The cause of this great difference in the death-rate of these two classes we must consider as depending principally upon the enormous increase in tuberculosis which in some of the orders claims nine times as many victims as in the general population. Typhus and typhoid fever claim a smaller part of the increased death-rate.

The cause of this phenomenon must be sought chiefly in the enormous increase in the death-rate from consumption among the nurses, with whom it finds nine times as many victims as in the general population. Typhus and typhoid fever, also have a lesser

influence, though it is the cause of eight or ten times as many deaths among the attendants upon the sick as among the general population.

An explanation of these great differences will not be difficult when we learn the method in which the labor is divided among the members of the orders. It is easily understood that during the earlier years of life in the orders, the probationist must prove his worthiness by doing the hardest and most disagreeable work.

We know on the other hand, that tuberculosis is caused, in the great majority of cases, by breathing the dried and pulverized sputum of consumptives. Those persons, therefore, who have to attend daily to the cleansing of the rooms and making of the beds of consumptives, and the removal and cleansing of handkerchiefs and other cloths which have been used as receptacles of the sputum are more in danger than others of inhaling the bacilli and thus infecting themselves. Therefore, as we have seen, the greatest number of infections occur in these years. With increasing age this work falls upon other younger and stronger shoulders, and the danger of infection is largely avoided, for, as I have set forth in another place, it is not the residence in the hospital, not the breath of the consumptive which is dangerous, but singly and alone the inhalation of the dried sputum, which is mixed with the dust of the floor and the bed, and which particularly in the morning's bed-making and cleansing is whisked into the air where it is likely to be breathed. We cannot wonder, therefore, that the older members, although they still remain at their duties as attendants upon the sick, are no longer infected so frequently as are those of younger age.

Table VI—*Abstract.*

No. of years of service.	No. of deaths for each year of service. Total deaths.	No. of deaths each 5 years.	Of tuberculosis.	Of other infectious diseases.	No. of years of service.	No of deaths for each year of service Total deaths.	No. of deaths each 5 years.	Of tuberculosis.	Of other infectious diseases.
½	11		2	9	31	14		3	2
1	120		69	33	32	12		2	2
2	176	709	111	38	33	8	49	2	1
3	140		104	18	34	7		-	1
4	140		110	19	35	8		-	3
5	122		98	10	36	9		2	-
6	114		93	7	37	8		1	1
7	104		81	8	38	6	31	1	-
8	106	505	72	9	39	5		1	2
9	96		67	10	40	3		-	-
10	85		61	7	41	5		-	1
11	59		43	5	42	10		3	-
12	57		41	3	43	5	35	1	-
13	70	300	49	6	44	8		3	-
14	63		38	6	45	7		1	1
15	51		39	3	46	4			-
16	51		33	5	47	2		1	-
17	32		24	5	48	3	16		
18	40	197	29	3	49	3			-
19	47		32	5	50	4		1	1
20	27		15	3	51	4			
21	34		20	2	52	4			
22	23		9	2	53	5	14		
23	21	134	5	3	54	-			
24	26		10	6	55	1			
25	30		9	5	56	1			
26	19		5	3	57	-			
27	14		4	1	58	1	6		
28	14	94	6	2	59	2			
29	21		7	2	60	2		1	
30	26		5	3	over 60	5	5		

From Table IV we learn that among each 100 deaths, 63 have been due to tuberculosis.

Table VI shows the relation of mortality to length of residence in the cloister, or order.

As is shown in column 2 of Table VI, during the first half year of service, the death-rate remains low, then rapidly rises so that during the first quinquennial period (see column 3) more than one-third of the total deaths occur. During the first ten years almost twice as many die as during all the other periods. At the beginning of the third year (see column 4) tuberculosis reaches its high-

est point. The same is true, also, of the other infectious diseases, as will be seen by referring to column 5.

From Table VII (omitted herewith) we learn that a healthy young woman of seventeen who binds herself to one of these orders and devotes herself to the care of the sick dies 21½ years earlier than one of the same age among the rest of the population. A nurse of 25 years of age has the same expectation of life as a person of 58 outside the orders, while one of 38 years is on a level with a 62 year old person in the general walks of life.

From the foregoing statistical material it is evident that the religious orders which are devoted to caring for the sick are subjected to an enormously high total death-rate and that the principal cause of this enormous death-rate is the prevalence of consumption.

To the abundant opportunities whioh nurses have in their close association with consumptive patients we must attribute the greatest cause of the enormous total mortality of persons engaged in the care of the sick, and particularly the high death-rate from consumption. And can we be surprised when we remember that in 21 hospital wards devoted to the treatment of medical cases, the dust from 15 of them (more than two-thirds) proved itself to contain virulent tubercle bacilli?

There is no need of entering into a discussion of the ubiquity of the tubercle bacillus, for in the light of the newer investigations, it is shown to be entirely untenable.

We may accept it therefore, as a verity that of those who consecrate their lives to the care of the sick, two-thirds of them become the victims of fatal disease, and a statistical record of their mortality becomes a monument to their sublime faithfulness, their noble, beneficent, and unassuming work.

ON THE CONTAGIOUSNESS OF DIPHTHERIA.

"All the world believes in the contagion of diphtheria," says Dr. Lancry, yet there are scattered in the world, at least in this corner of it, persons or groups of individuals who are not sure that diphtheria is a communicable disease, and whose disbelief is a constant menace to the safety of themselves and the whole community when diphtheria is prevailing. Diphtheria should be classed with small-pox and scarlet fever as one of the dangerously contagious diseases, and is now so classed by all leading authorities in this country and in Europe, and until the people are convinced that the dilly-dally policy is a most dangerous one, the infection of diphtheria will find its victims, and this disease will continue to be the most terrible one of modern times. It is necessary, therefore, to keep before the public mind the fact that diphtheria is contagious, and that its spread and prevalence are due almost entirely, if not wholly, to infection. That is the reason why we publish the following:

Dr. Charles E. Banks, Surgeon U. S. Marine Hospital, Portland, Maine, writes:

In the month of March, 1888, a gang of men were loading and storing ice in the storage house at the Marine Hospital, and one of the workmen had two cases of diphtheria in his family, as was later ascertained upon investigation. A young child of one of the hospital employes was playing about the teams and with the men while the work was in progress. In eighteen days he died from heart failure due to catarrhal diphtheria, with which he had been ill since the date of the work mentioned. No other case occurred in the building. Carpets, clothing and furniture were destroyed. Sulphur fumigation was employed for hours, and the walls washed with Labarraque's solution and the floors with strong mercuric bi-chloride over and over again. The occupants at that time have long since gone and the rooms have been occupied by others with children, and no further developments have been noted. Complete isolation was enforced during the period of disease.

Dr. C. E. Williams, of Houlton, writes: I know of an instance of a cradle in which a baby had been sick and died of diphtheria. Several months afterward, the cradle was lent to another family, whose children were soon after attacked by the disease. The cradle had not been disinfected.

Dr. J. A. Steadman, of Georgetown: I know of a case imported from Massachusetts into this town through the medium of infected clothing. The importation of the disease occurred six months after the clothing had been used by a patient who had died of diphtheria in Massachusetts. The recipient of the clothes also died. The in-

fection, I think, is often contracted from clothing during the process of washing.

From Dr. G. A. Wheeler, Castine: I suppose few, if any, doubt the direct contagiousness of diphtheria. That it can also be carried by fomites and by third persons I believe, and have given illustrative cases in a previous report. My experience does not lead me to believe that diphtheria is a filth disease, although unsanitary conditions always aggravate the severity of it. I have been able to trace nearly all my cases to a previous possible source of contagion, and I have known diphtheria to prevail and families to escape the disease, whose surroundings were exceptionally bad.

Dr. F. A. C. Emerson, Garland: One case of diphtheria was communicated through clothes from the family of the washer-woman. The period of incubation in this case was three days and the duration ten.

Dr. F. W. Bridgham, Health Officer, Sullivan writes: Diphtheria started in March, 1887 in a family living on the line between this town and Franklin; four cases occurred in this family with one death (septic form). No other cases occurred for a long time. In June a case occurred in a family about two miles from the first. It appeared upon inquiry that this patient had been building a pasture fence near the house where the first case appeared and had discovered some clothing thrown out from the house instead of being burned. He handled this clothing throwing it over the fence. I have no doubt that he caught his diphtheria from these rags.

Dr. C. A. Peaslee, Health Officer, Wiscasset: In 1887 diphtheria was found in two families. In the first family it appeared to have been developed in a peculiar way. The eldest daughter had been in Boston about a month, when a letter was received from her saying that she had been sick with a sore throat. A few days later the youngest daughter took diphtheria at home, and a week afterward another daughter came down with the same disease. Both of these cases recovered. Subsequently a careful enquiry was made in regard to the Boston case, and it was found that all three cases were identical—catarrhal diphtheria. Now did all three of these girls happen to contract diphtheria at about the same time? Can anyone suppose that diphtheria came from Boston in a letter? A careful search was made for any possible source of infection, but none was found, unless possibly the drinking water which was found to be impure might be supposed to have a causative relationship.

Dr. J. R. N. Smith, Milltown: A daughter from a family in Baileyville about twelve years of age, was attending school at the Convent in Calais, when she was taken with sore throat and Dr. — was called in to see her, and sent her home. At home they continued to treat her according to his directions, but did not isolate her from the other children who were attending school at home. The neighbors, finally, objected to their attending school. One day as I was passing, the father called me in to examine the girl, and say

whether in my opinion there was danger of contagion. I told him that I thought that the girl had had a mild case of diphtheria, but that she appeared to have entirely recovered, so that there was no contagion from *her*, but that his *house* was *full* of *danger*, and urged him to take every precaution possible in cleansing it. I do not think that he did a thing. In about a month a boy about ten years of age was taken sick, and he went to Dr. — and asked him to give him medicine, which he refused to do, telling him he needed a physician to see the boy. Then he called me and I found very little trouble with the throat, but the bronchial tubes were fearfully involved. I again urged isolation and disinfection, but without avail. The boy died, and an older one, who was at work from home, returned to attend the funeral, and took the disease and died about a week ago.

Dr. J. A. Walling, Millbridge: The cases of diphtheria which I attended in 1888 were due to contagion. My first case, a boy of ten, contracted it from a family living near. He had it in a mild form, and recovered in five days. The second case was in a child of eight years. She also contracted it from a family living across the street. No measures of importance were taken to prevent the spreading of the disease. She died in six days. Her sister was taken the day after her death (the seventh day from the infection of the house). She recovered in two weeks. The fourth case was in another part of the village, fully a mile and a half from the other cases, but here also I think that it can be traced to direct contagion. This case was also mild, recovering in two weeks' time. The fifth case was of a girl of twelve, in a family that had lost three children the month before from the same disease. She recovered in two weeks. The rest of the village, which is separated from the locality by a river, escaped with two cases, which were probably due to direct contagion.

In most of those outbreaks of diphtheria in which it is reported that the disease could not be traced to contagion, the failure to find its source does not by any means exclude the possibility of such origin. In such cases the discovery of the thread which shall unravel the mystery can only be found after a most exhaustive inquiry into all the facts concerning the life of the infected households and their friends, and their goings and comings. This requires time, and often much time, and in how many cases have we the assurance that the investigation has been carried out with sufficient care? The following from the Seventh Annual Report of the State Board of Health of Michigan is a good example of what may be done by one who is interested in the work of tracing out the various steps of an epidemic. The communication is from Dr. E. N. Palmer of Brooklyn, Michigan.

1st Series of Cases. (Family of Stephen Rice.) Case 1, Fletcher R., aged 13 years; attacked July 20th, with diphtheria, croupous form. Duration 8 days; termination, fatal. *Concerning contagion.* No exposure anywhere, as far as could be ascertained. Cases 2 and 3, Charlie R., aged 15 and Ada R., aged 5; taken sick July 28th. I saw the two latter July 30th, in counsel. Both had the malignant form. (Advised removing the other two children from the house, which was done, and they escaped having the disease.) Ada died the 5th of August; Charlie recovered. No public funeral was allowed, and no one was allowed to visit the house, except the nurse and physician.

2d Series of Cases. (Family of Knowles, a farmer, one mile from Rice's.) Case 4, Henry, aged 25; attacked August 2d. Disease ran 7 or 8 days terminating favorably. *Concerning Contagion.* He had been nowhere where there had been diphtheria that he knew of; but *had conversed several times with the father of the Rice children, while they were sick.* Case 5, Charles W., who was helping case 4 run a threshing machine when case 4 was taken sick; attacked August 6th. Disease ran 7 or 8 days and terminated favorably. Two children of Geo. K., at whose house case 5 stayed during his sickness, were both taken sick August 13th, with chill, fever, vomiting and sore throats, the throat being the essential difficulty; but no membrane appeared, except a few white spots. Disease ran 7 or 8 days. I did not record them as cases of diphtheria, although I am of the opinion that *that was the difficulty*, and treated them accordingly.

3d Series of Cases. (Family of ——.) Cases 6 and 7, Milo F., aged 10, and Willis F., aged 8; were not sick enough to need a physician, and recovered in the usual time. *Concerning Contagion.*—When my attention was called to these cases I could not suspect that they were derived from contagion; but after some time the father recollected *of conversing a half hour or more with Mr. Corey, of Kelley's Corners, together with the boys, seated round the stove.* Mr. Corey had been sitting up all the night previous with a case of diphtheria; had laid out the child and come here, a distance of five miles, to procure a coffin, *without changing his clothes.* Case 8, Minnie S., aged 8, taken sick October 9th. The disease was quite malignant, but the child recovered after some two weeks. There were seven cases following these, of which I have no record, as they were treated by another physician—two in each of the houses adjoining the above, and three directly opposite, across the street; all children except one; and as the families are usually intimate, there was *almost constant intermingling of the children.*

4th Series of Cases. (Family of P. Cromb, a farmer.) Case 16, Myra Cromb, aged 6; taken sick October 14th, at school, about 10 A. M. She remained in school until 4 P. M., and then went home during a rain storm, a distance of 1 3-4 miles. She died on the 7th day. *Concerning Contagion.*—Ten days previously the mother and her two children had spent the day at Mr. F.'s (cases

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6 and 7). Cases 17 and 18, Ida Cromb, aged 3, and Mrs. Alice Cromb, the mother; taken sick October 18th. Both recovered. Case 19, Miss A. Cromb, aged 25, sister to husband; came from Clinton to help nurse, October 20th. She was taken sick October 26th with diphtheria. The disease ran its usual course, and she was able to go home in two weeks.

5th Series of Cases. (Family of W. A. Bartlett, a farmer.) Case 20, a babe 18 months old; attacked October 23d, membrane filled throat and nose; glands of neck swollen badly; recovered. *Concerning Contagion.*—Mrs. Cromb (case 18) went to Mr. Bartlett's house October 16th, after some hops. *She remained an hour or more and took the child on her lap.* Case 21, Daniel Dubois (half brother) aged 11; attacked November 6th. Malignant diphtheria running its usual course, but recovery was somewhat slow, with paralysis of vocal cord. Case 22, C. K., in same house, aged 30; attacked November 11th. Recovered.

6th Series of Cases. (Family of E. E. Ferguson, a farmer.) Cases 23, 24, 25 and 26, Harry Hooper, aged 4; Charles F., aged 10; Feba F., aged 8; and Henry F., aged 12. Case 23 was attacked October 27th, and the other three October 29th. *Concerning contagion.* All these were mild cases and they were *all at school with case 16, and came home the same road for a mile and over together.*

7th Series of Cases. (Family of James Stuart, a farmer.) Case 27, Clarence S., aged 6; attacked November 21st. The membrane was not very extensive, but was succeeded by croupous symptoms and he died on the 28th. *Concerning contagion.* Cases 17 and 18, Mrs. Cromb and her daughter had gone to spend the winter from their home to her father's whose house was just across the road from James Stuart's; and 8 days previous to his attack *the boy was over there and spent a part of the day.* Case 17 had not fully recovered at that time. Case 28, Frank Stuart, aged 3; attacked November 27th. The disease was mild and he recovered.

8th Series of Cases. (Family of George Collar, a day laborer.) Case 29, Della Collar, aged 12; attacked October 28th. The case was very malignant and she died of paralysis of the heart. *Concerning contagion.*—She had been back and forth and to school every day with cases 6 and 7. Case 30, Cora C., aged 9; attacked November 4th. This case was quite malignant, but recovered.

I find that if I should report all the cases in full that bear upon the points mentioned in your letter it would take too much space; consequently I change the program and classify cases as follows:

Libby King, aged 14, and Maggie H., aged 11, pupils in grammar department; both taken with diphtheria November 9th. The first sat with, and the other on the seat directly in front of, Nellie Ide, whose brother was sick with diphtheria, and had been for ten days previous to the 9th of November. Nellie was in and out in the sick room as she pleased, and was attacked herself about a week later. There had been no other exposure, and those three were all of the

cases in that department, except those who were exposed by direct contact at home. Johnny Sheridan, attacked November 17th, in primary department, sat in seat adjoining cases 6 and 7 before mentioned.

Diphtheria may be communicated by *direct* contagion, as from the patient to another person, or *indirectly* through the medium of infected articles, or by persons themselves escaping the disease, but nevertheless infectious on account of having been in contact with persons sick with diphtheria or having been within the infected atmosphere of the sick room.

DIPHTHERIA BY DIRECT CONTAGION.

Cases illustrating both direct and indirect contagion have been given in the foregoing.

Many physicians and surgeons, especially the younger members of the profession, have fallen victims to the infection received while in the path of duty. Many sad cases of loss of life have been the result of that sudden impulse which sometimes drives the surgeon to apply his lips to the tracheotomy tube, when the question is the instant clearing of the way for the air or the loss of the life of the patient. One of the saddest cases of this kind was that of the gifted Carl Otto Weber. Francotte* gives a long list of physicians who have been infected by their patients, many with very unfortunate results, the following are a few of his cases:

"Trosseau has given an account of the sad end of Valleix. He was treating a child for diphtheria. It was not a severe case and thanks to the careful treatment of my unfortunate colleague, the child recovered. But one day, as Valleix was examining the throat a sudden spasm of coughing projected saliva from the mouth of the child to the lips of the surgeon. He became sick, and on the next day false membrane was visible on the tonsils, and, a few hours later, both tonsils and the soft palate were covered with the pseudo-membrane. Death followed within forty-eight hours.

Herpin unfortunately had a bit of the false membrane from the throat of a diphtheritic child blown into his left nostril. A few hours later he was affected with inflammation of the nostrils, nasal speech, and difficulty of swallowing. False membrane extended itself over both tonsils and the soft palate and reformed successively three times. Herpin recovered, though paralysis occurred as a sequel.

While doing a tracheotomy upon a child with diphtheritic croup Bartels blew suddenly through the tracheotomy tube to dislodge the false membrane. Three days later he was attacked with severe febrile symptoms, pain in the throat, and diphtheria.

*Die Diphtherie, uebersetzt von Dr. M. Spengler.

Dr. Lancry* refers to the larger number of *internes* of the children's hospitals in Paris who have died with diphtheria contracted from their patients. On one of the most conspicuous walls of the hospital l' Enfant-Jesus may be see a black marble with the following inscription in letters of gold.

A LA MEMOIRE
DE

HENRI GIPOULOU
Interne provisoire
Diphtherie (1875)
—
LEOPOLD POIRIER
Elève en Pharmacie
Angine couenneuse
(1877)
—
EMILIE PERIER
Religieuse
Angine couenneuse
(1878)
—
ARTHUR PREVEL
Eleve en Pharmacie
Variole (1878)
—

J. ABADIE TOURNE
Interne en Medecine
Diphtherie (1879)
—
FERD REVERDY
Externe
Diphtherie (1880)
—
JOSE ANGULO
Externe
Diphtherie (1880)
—
WILBIEN
Externe
Diphtherie (1885)
—
DUSSAUD
Interne provisoire
Diphtherie (1886)

Morts Victimes de leur Devouement
LA VILLE DE PARIS RECONNAISSANTE

A LA MEMOIRE
DE
GOUGET
Externe
Diphtherie (1860)
—
GARY
Interne en Medecine
Diphtherie (1875)
—
HENRI CARRTTE
Externe
Diphtherie (1876)
—
HERBELIN
Interne en Medecine
Diphtherie (1880)
—
JULIO ALPHONSO
Externe Provisoire
Fievre typhoide

Morts victimes de leur devouement La ville de Paris reconnaissante

DIPHTHERIA BY INDIRECT CONTAGION.

Some physicians who have admitted the contagiousness of diphtheria by direct methods have doubted whether the disease is often communicated by indirect ways—for instance, transportation in infected clothing. On the other hand the majority of our leading medical authorities assure us that the infection of diphtheria is endowed with a vitality which is very persistent, and that it is remarkable for its power of attaching itself to material things, clothing, furniture, rooms, etc.

We have from as eminent an authority as Dr. Liebermeister the opinion that "in a great majority of cases, the infection is communicated indirectly, without any immediate contract with the patient." The following may serve as additional cases for the illustration of indirect methods of contagion.

*De la Contagion de la Diphtherie, Paris, 1886.

An isolated farm house occupied by a family composed of father, mother, four children, and three servants, had had before the outbreak of diphtheria in their house no communication with the other house whence it was subsequently believed the infection had been transported. The locality was elevated, dry, and with no prevalence of diphtheria in the neighborhood. On the 18th of October it was discovered that a child of eleven had diphtheria. The next day the father the mother, and another child were attacked. On the 26th, 27th, 28th, and 30th, of October, the servants became sick with the disease one after the other.

It was learned, upon inquiry, that three days before the first child showed symptoms of diphtheria, a woman from the village had brought to the farm house some sewing which she had been doing for the family in her own cottage where it was found that two children had been sick at the same time. One of these children died suddenly of what was called bronchitis, the other, seen by a physician, who is an officer of the medical police presented well marked signs of diphtheria. The child who died, had recently been on a visit to her friends in a distant city where diphtheria prevailed. It was evident that the infection had been imported into the farm house by the seamstress. She lived two miles away from the farm house, and had not had the disease herself*

In his *Etudes D'Hygiene Publique* (1886) M. Ollivier reported the following facts: The regretted Prof. Parrot was called one day to three children of the same family all attacked simultaneously with diphtheria. All of the three children died. Investigating as to the cause of this outbreak, M. Parrot discovered that a few days before, these children had ridden in a carriage, which had served the same morning for the transportation of a diptheritic patient to the hospital des Enfants-Assistes.†

In the ninth volume of the *Revue D'Hygiene* there is an interesting paper by Dr. Thoinot on what he calls one particular point in the etiology of diphtheria: Can a person leaving a focus of diphtheria and himself remaining free from the disease transport it to others where he goes? And if this is true, how can we conceive that the transportation is effected? In seeking to answer these questions the following cases are cited:

In the first outbreak which is narrated, contagion appeared to have a part in the development of the primary case. This first case, a young girl, lived at a house to which, a few days previously, a person had come from a neighboring department which had been ravaged by croup, and where he had come in contact with two persons sick with this disease. This house became a center of infection for the neighborhood.

The second history is as follows: For more than forty years there had been no epidemic of diphtheria in the town of Mantes,

*Lancry, De la Contagion de la Diphtherie, Paris, 1886. †Ib.

only at rare intervals an isolated case, and this was more remarkable in that the neighboring communes had been infected.

From the 15th of October, 1883, to the 31st of December there occurred an abrupt outbreak of thirteen cases of diphtheria of which ten were fatal, and from Januaiy to March, 1884, there were about thirty cases. The beginning of this epidemic, the first for a long while in Mantes, appeared to have been as follows: On the 15th of October, two brothers dwelling in a house on the Rue Porte-aux-Saints took the disease and speedily died. A few days before they were attacked with the disease, a child came from Paris from an infected house, but who had not himself been sick, and stayed in this family where this disease first made its appearance on the Rue-Porte-aux-Saints.

The third history narrates an outbreak of diphtheria in an educational establishment at Dijon which occurred near the close of 1883. In this school there were 220 young ladies from the age of 13 to 20 years. After the outbreak the number of cases was rapidly multiplied, and the infirmary was filled, there being fifty cases of the disease. Sixteen severe cases were removed to the hospital; eight died. The school was disbanded for three months, and the pupils were sent to their homes or put into the families of strangers. They naturally carried with them all of their clothing, and without being disinfected.

One of these young ladies, who had not had the disease, was sent to the village of Cissey. A short time after the arrival of this young lady, two children in the house where she had been sent, were seized with diphtheria and died. These two cases became the origin of a small epidemic which affected seven other children of whom several died.

But this is not all; another pupil from this school in Dijon was sent to her parents near the village of Plombieres where there had been no case of diphtheria. One of the parents of this pupil took the disease soon after her arrival and died.

Another case narrated by M. Thoinot was of a young man residing in Algiers who was attacked with diphtheria which proved fatal. After his death his clothing and other effects were packed up and sent to his brother in the town of Laval in France. When this package was received, it was opened by the brother to whom it had been sent. He was soon afterward seized with diphtheria and died in three days.

These cases, though presenting no testimony of a new character, are interesting and are always instructive to the general public.

MILD OR QUESTIONABLE CASES OF DIPHTHERIA.

It is not sufficiently understood that diphtheria often assumes a very mild form, and that, nevertheless, the infection from extremely mild and sometimes questionable cases may give rise to diphtheria of any grade of severity up to the most malignant cases. The following communications from our Maine physicians illustrate several points in regard to these mild cases:

From Dr. H. F. Twitchell, Freeport.—An outbreak of diphtheria in a locality where some ten years ago it prevailed extensively. Could not trace this origin. Many children in the neighborhood exposed and sick slightly, but only one called a physician. That child threw off complete casts of soft palate and tonsils, the disease being followed by an extensive paralysis and abdominal dropsy. Had it not been for this one case the epidemic presented so mild a form that it would not have been recognized.

A young man came from a logging camp with deep abcesses of neck. Had been cases in camp of supposed diphtheria, and had had sore throat. Some of his brothers and sisters had "white sore throats" in about a week after he came home. Two other children exposed by them afterward had diphtheria. This instance and some others lead me to believe that diphtheria may occasionally occur in connection with epidemics of simple sore throats, or follicular tonsilitis.

Dr. G. A. Wheeler, Castine: I have often seen diphtheria contracted from mild and apparently non-contagious forms of sore throat. In the fall of 1886, during the prevalence of diphtheria in the neighborhood, I was called to see a young girl who had an enlarged tonsil with three or four whitish specks upon it. There was no enlargement of the glands and two days later no deposit on the tonsil and no evidence whatever that the child was ill. A week later the mother had a sore throat but no deposit whatever, the throat presented nothing unusual except a peculiar dark red appearance. About a week later a young man in the house was taken with malignant diphtheria and died within 48 hours. No possibility could be traced outside óf the family.

Dr. J. R. N. Smith, Milltown: There is a family living in Alexander from which a daughter eighteen or nineteen years of age, came to Milltown to work in the cotten mill and went home with a sore throat. She was not very sick and had no physician; after her recovery two or three others of the family had sore throats, every case seeming to be more severe than those preceding until two boys, one ten and the other twelve were so very sick that I was

called, and I found their systems so completely saturated with the poison that I had but little hopes of their recovery. They both died of diphtheritic nephritis, as also a boy about the same age in the next house. Both houses were thoroughly cleansed and there has been no more trouble.

Dr. Jason Walker, Minot: A family residing in the suburbs of Auburn in the summer of 1880, received some second hand clothing from some locality out of the State. The wife and mother of this family washed this clothing, and in a few days had a sore throat, not severe enough to call a physician. In a few days more, the eldest child was taken with a sore throat, and one after another of the children were thus taken, until all in the family, five in number, had what proved to be a malignant form of diphtheria, and four of them died. One of them, being seen early after the attack, was saved.

Dr. C. Flower, Princeton: It has occured to me to witness, on two different occasions, a mild form of diphtheria, which did not cause the patient any inconvenience, produce in others who contracted the disease from him a most malignant and fatal form of the disease.

Dr. Donald W. C. Hood, Senior Physician to the West London Hospital, contributed to the *Lancet* a few months ago a paper with the title of "Clinical Notes on Diphtheria," and among other cases he narrated the following:

A lady was seen by me in November, 1883. The tonsils and palate were covered with a membrane. Two days later four children were attacked with sore throat, one only having membrane. All had glandular enlargement, with fever. In no case was albumen present. The outbreak occurred in a large country house. Nine persons in all suffered. The house was built in two wings, east and west. The east wing contained the children's rooms, and the waste pipe from the bath attached to the nursery was found running untrapped into the soil pipe. Diphtheria had been very prevalent in the neighborhood. It was possible to remove all the sick into a part of the house uncontaminated with sewer-gas. A good recovery was made in each case. This outbreak was interesting and instructive; it showed conclusively how the specific poison of diphtheria might affect individuals with different degrees of intensity. Two throats were found covered with membrane. Two of the children had no sore throat, but swollen glands and a slight rise of temperature.

A child, aged eleven, first seen by me on May 25th, 1883. The child had been poorly for two days, and was thought to have taken cold. On the third day a slight rash was observed on the chest, and I was asked to see the patient. The rash was erythematous. Temperature 102.5°; pulse 120. The tonsils were swollen and painful, and injected with small isolated points of pseudo-membrane.

The glands at the angle of the jaw were enlarged and tender. The same evening the temperature was 103°. The rash had all but disappeared. The right tonsil was free from membrane; the left had the same appearance as in the morning. The following day the temperature was normal. There was no trace of membrane on either tonsil; no albumen. The child seemed to be well. On the evening of this day another child, aged three, was fretful and feverish, the temperature being 102. There was much swelling of glands, the parotids being also swollen. In fact, the appearance simulated an attack of mumps. There was no sore throat. It was carefully examined, and no trace of inflammation or membrane could be detected. The following morning a third child was taken ill. Here, as in the last case, the prominent symptom was the swollen parotids and glands at the angle of the jaw. Temperature raised, tonsils and fauces slightly injected and sore. On the same day the fourth child fell ill with fever and swollen glands. The glands in this case were enlarged two days before the trouble was referred to the throat. On the third day of illness, membrane appeared on one tonsil. It quickly spread and during the following five days appeared to implicate the tonsils, soft and hard palate, walls of pharynx, and nasal cavities. As the child lay in bed, a sanious discharge trickled from the nose. The child was extremely fretful and irritable. It was impossible, excepting with force, to carefully examine the throat. On the fifth day of illness, Sir William Gull saw the little patient with me. He gave but slight hope of recovery, he stated that he did not remember ever having seen such a copious deposition of membrane. * * * * * *This outbreak was traced to direct infection from one of the under servants, a kitchen maid, who, I ascertained, had been suffering from a "slight" sore throat* for two or three days. When seen by me the girl was performing all her household duties, among which was taking up the nursery meals. She declared that she felt perfectly well, her throat being at the time almost completely covered with membrane. In this outbreak, as in the last, it was interesting to note the different effects of the poison. The first case, if seen without the other, would certainly have been looked upon as but catarrhal tonsilitis. The illness simulated that disease as closely as the second did an ordinary attack of mumps. All patients were under favorable circumstances for recovery, the house, standing high, had been drained under the supervision of one of our leading sanitary engineers, and was without flaw.

K. D——, aged nineteen, a domestic servant. Admitted on April 26th, 1887; discharged well on June 17th. This case presented much difficulty in respect to diagnosis. She was admitted for general debility and anæmia. On examination, a muco-purulent discharge was seen adhering to the posterior wall of the pharynx. It could easily be removed, and when floated in water presented the ordinary appearance of muco-pus, such as is often found adhering to the pharynx in catarrh. There was no history of sore throat. The glands were not enlarged. Two days after admission

a fresh crop of membrane occurred on the tonsils, and there was a small amount of albumen in the urine, the principal symptom being still want of power. On the twelfth day fluid regurgitated through the nose and the voice assumed a nasal character.

Although the series of cases reported are but few in number they enforce definite facts in the clinical history of diphtheria. They teach us that the character of the membraneous exudation is not of prime value with regard to diagnosis or prognosis, the mere quantity of membrane being no criteron of the intensity of the attack or liability of the patient to laryngeal implication. It has been long known that in a neighborhood of an outbreak of diphtheria numerous cases of sore throat are found presenting appearances of more or less of diphtheritic nature. If such cases be classified, they will be found occupying a curve, at the bottom of which may be placed simple relaxed sore throat, and at top the true membrane variety. We may see the same phenomena in an outbreak occurring in a single house: Cases one and two enforce this truth.

We are so accustomed to look upon diphtheria as distinguished by membraneous exudation on the throat that there is dangei of our overlooking the other less marked results of the same disease. In other words, may we not sometimes find the disease expressed without its local throat manifestation? I attach much importance to the history of the cases one and two referred to in this paper. In these outbreaks the extreme glandular enlargement was so decided, so marked, that, as I have stated, if seen alone, without knowledge of the evident cause, mumps would have been looked upon as the causative agent. Seeing these cases of enlarged glands without a trace of throat trouble, one could not refrain from asking the question, May not diphtheria occasionally express itself as affecting glands alone? Some few months past a case occurred to me which appeared to have an important bearing on this question. I was asked to see a child aged nine, who had been poorly for two or three days. I found the child with the left parotid and the glands at the angle of the jaw much swollen and painful; pulse 120; tempera ture 102°; no trace of throat mischief. The child had had a well marked attack of mumps the previous year. The tongue was coated, and there was much cardiac debility, in fact, the little girl, the first morning I saw her, had a severe attack of syncope while I was present. The child continued in much the same state for four or five days, on the whole getting better. There was no evidence of bowel trouble or symptom that the illness was enteric. The house had been newly built, and had been drained under the supervision of one of our best engineers. But I could not help feeling suspicious that sewer-gas was the cause of the illness. The child was removed to another house; the following day there was a decided improvement, and a rapid recovery took place. I obtained the services of my friend Mr. Shirley Murphy. He examined the drainage, and reported that a grease trap in communication with the main drain had not been attended to; it had overflowed and was blocking the drain, sewer-gas being forced into the house.

The relation of tonsilitis to diphtheria is often a matter of discussion, and here again we may gain help from a study of the cases I have reported, tonsilitis of a follicular character being found in several instances in which the cause was undoubtedly diphtheria. A few months ago one of the nurses at the West London Hospital had a mild attack of so-called follicular tonsilitis. The throat mischief speedily improved; there was no coalescing of spots, but a few days later symptoms of paralysis supervened and declared the initial attack to have been diphtheria. There can be no doubt that benign-looking tonsilitis may be symptomatic of diphtheria. On the other hand, a most severe attack of the same disease may be absolutely without much specific taint.

Dr. Charles Warrington Earle,* in speaking of these questionable cases of diphtheria, says:

In view, however, of the fact that some of these very mild cases have proven markedly contagious, it is a question to me as to whether the physicians who call them diphtheria and treat them as such are not in the main correct. My conversion to this precedure was brought about as follows: In 1873 I was attending a family on North Ada Street, consisting of four girls and one boy. The female children had sore throats, characterized by redness, some pain, and a few white spots. It was diagnosticated as follicular tonsilitis, and the parents were informed that there was absolutely no danger. In the the course of a few days the boy was taken with the same symptoms, which rapidly became more alarming. General infection took place in the course of two days, and death resulted. I had always thought that if I had diagnosticated diphtheria in the first patients, treated it as such, and sent the boy away from the infected locality, he might be alive to-day. This, with other cases, has changed my diagnosis and practice entirely.

About six years ago I was treating a case on Erie Street. It was a mild one and recovered rapidly. During the course of the treatment a relative of the family was journeying, with two children, from the East to their new home in Dakota, and stopped for twelve hours in this infected house. Neither the mother nor the children were in the room with the mild case I was treating; indeed, not on the same floor of the house. They remained a single night in a remote part of the house, and in the morning resumed their journey. A week after arriving in Dakota one of the children sickened and died, in another week the remaining child died, and the mother barely escaped death from the same disease.

Although the contagiousness of this disease has been recognized for two hundred and fifty years, we at this day find members of the profession denying it, and refusing the greatest safeguard to not only their own families, but to the public at large, in casting their influence against isolation and other means to prevent the spread of the disease.

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*Archives of Pediatrics, May, 1889.

On February 13th, 1889, an interesting and notable discussion followed the reading of a paper by Dr. J. H. McCallom before the section for clinical medicine, pathology and hygiene of the Suffolk District Medical Society.* He began his paper by saying:

It is known that diphtheria has been quite prevalent in the city during the year; but it is not so well known that it has been very generally distributed thoughout the whole extent of the city. That imperfect drainage and poor hygienic surroundings have much to do with the prevalence of the disease is admitted; but an additional factor is required to explain the dissemination in localities which have been hitherto comparatively free. This factor is contagion; not so much from the severe and the recognized forms of the disease, as from the mild and unrecognized types, particularly the nasal. The children who have this form of the disorder are apparently well, attend school, and are brought in immediate relationship with other children and communicate the disease to them. In many of the cases an absolute diagnosis is impossible, for there is nothing to be seen in the throat; and there is only a small patch of membrane to be found in the nose. This is transient in its nature, and by the time a physician is summoned there may be no positive trace of the disease.

In the discussion which followed, Dr. Durgin, Chairman of the Municipal Board of Health said: I have no doubt that a great deal of the spread of this disease is from the mild cases which are allowed to attend school. I have known quite a number of cases where a child, sitting next another with a sore throat which subsequently proved to be diphtheria took the disease. It seems to me that the secret of the vast spread of the disease over so large a portion of this city is found in the mild cases, which it is almost impossible for a physician to diagnosticate early, and sometimes not at all."

Dr. Morton Prince said: I think we are indebted to Dr McCollom for bringing forward this matter of the part played by contagion from mild cases. I think it a point of great practical importance. It has been my lot to investigate a very large number of these cases of diphtheria recorded on the chart, and it has been my constant, I might say almost daily, experience to meet with case after case of undoubted diphtheria, where there were patches of membrane in the throat, and yet the symptoms so mild as not to compel the patient to be put to bed, and the child was allowed to run about mingling with the rest of the family, going about the streets and alley ways; I think that there is no question that such cases are the most prolific sources of contagion.

Another source of danger arises from the severer cases that are allowed, before convalescence, to go around in the same way. I am satisfied that it is very common for children of the poorer classes to go about during convalescence, the physician often saying that the danger is passed simply because the membrane has passed away.

* Boston Med. and Surg. Jr., March 21, 1889.

SPONTANEOUS ORIGIN OF DIPHTHERIA.

Can diphtheria originate *de novo?* The progress of our biological knowledge has drifted us far from the belief in the spontaneous origin of animal or vegetable life. At the same time our clinical and etiological studies have made the idea of the origin of small-pox, scarlet fever, and almost every other infectious disease a belief of the past. In the light of what we now know about the causes of diseases, can we longer hold that a disease clearly known to be infectious, originates commonly and frequently, independently of antecedent cases of the same disease? Our modern knowledge of the parasitic nature of contagious diseases, shows them to be due to the multiplication and growth in the body of micro-organisms, and it is altogether likely, and is generally conceded, that diphtheria is no exception as to its parasitical origin. Shall we, therefore, in our disbelief in the spontaneous origin of life, make an exception of the diphtheria bacillus of Klebs, Lœffler and Roux and Yersin? There is, as it appears to the writer, only one way in which we may rationally retain the belief in the spontaneity of diphtheria in a modified form. Assuming that the specific cause of diphtheria is the Klebs-Lœffler bacillus or some other bacterium, clinical and epidemiological observations, irrespective of the help from the bacteriologists, have shown that the specific micro-organism is endowed with a persistent vitality. Infected clothing and infected rooms have many times been known to retain and communicate the infection months or years after they were infected. It is therefore entirely safe to assume that the bacillus of diphtheria, dried and wafted abroad in the open air, free, or clinging to filamentous particles, may retain its viability for some time. These germs may be carried a long distance by the wind, but all the particulate contents of the atmosphere, the pathogenic with the other elements, of course, have a tendancy by virtue of their high specific gravity, as compared with that of air, to fall to the ground again. When, in the process of ventilating infected rooms, the infection-laden air is poured out, it is so immensely diluted in the great ocean of external air that, practically, we may consider its harm-producing abilities as annihilated; yet it is conceivable that a stray bacillus among the millions may, in the subsequent process of ærial sedimentation, find a human being and even a susceptible one. Or, if we are to give credence to the idea which some hold,

that the infection of diphtheria may sometimes find a congenial soil for its preservation or multiplication outside the animal organism, it is also conceivable that occasionally a bacillus transported by atmospheric currents may fall upon soil which is favorable to it. With qualifications of this kind understood, it may not be unscientific to still admit the possibility of the spontaneous origin of diphtheria; but in view of the facts that the contagion of diphtheria is endowed with a persistent vitality, that it may attach itself to articles and be transported in a great variety of ways, and that many cases of diphtheria pass unrecognized, is it not more reasonable to assume, in a given case which is not traced to infection, as we are often obliged to assume of outbreaks of small-pox and scarlet fever, that there exists nevertheless a source of infection which has eluded our finite powers of investigation?

Dr. W. W. Thomas of Yarmouthville, in a communication on this subject, writes as follows:

I have no doubt that many cases, and so-called epidemics have been caused by persons going into society or visiting or traveling with a sore throat which they had no reason to believe was contagious, it being so mild that it gave them but little trouble. These are the kind of cases for which sink spouts and cess-pools are blamed as no other cause can be found for them. When we had our malignant cases here, five years ago, ten cases at one time in one house occupied by three families, a peddler who was also a "quack" and peddled among other things his worthless remedies, tried hard to get into the house and see these patients to palm off some of his "sure cures" upon them. Had he been allowed to do so he would then have continued to call from house to house on his peddling career. Such a man is more dangerous in a community than a dozen scorpions. This is a source of contagion that has not been thought of much, but I think that it will account for some of these cases of unknown origin.

Dr. E. R. Jacobi says: "There is probably no spontaneous origin of diphtheria, any more than there is a spontaneous origin of cholera or scarlatina."

Francotte says: In the realm of positive facts, it is impossible to solve the question for or against the autochtonic origin of diphtheria, but when we revert to theoretical considerations, we are compelled to believe that the spontaneous origin of diphtheria is not very probable.

Lancry's conclusion is that "the spontaneous genesis of diphtheria is very improbable."

IS DIPHTHERIA A FILTH DISEASE?

This question has some relation to the one just discussed. Can filth *per se* give rise to outbreaks of diphtheria? The belief that it may is hardly tenable at the present day. May collections of filth serve as culture grounds in which the infection may multiply if it happens to be introduced into such places? There is more reason to hold that this may be possible. Klebs* says:

"There are localities in which diphtheria has become endemic, and this irrespective of the conditions of climate, life, water and air. Diphtheria is therefore an infectious disease, the germs of which may grow and multiply in the immediate surroundings of man and his dwelling and may there long remain latent but still potent for mischief; it is therefore truly a house disease."

The following case from Francotte's work, but which was originally reported in the *Revue D'Hygiene* may be taken as illustrating this supposed origin of diphtheria.

In Raffetot, a very healthful village of 700 inhabitants lying upon high land, there had lived for a long time a tripe cleaner, whose house, surrounded by a small yard, lay some thirty-five feet from a pool of water. The water from this pool, though insufficient in quantity for the purposes of this industry, was used in his work and then was permitted, with its accompanying refuse animal matter, to flow back into the edge of the pool, where it was evaporated. In consequence of this the pool, situated only a short distance from the street, distributed such a stench that horses in driving by, encountering it unawares, would shy. It finally became a serious public nuisance. In March, 1866, a farmer of the vicinity conceived the idea of using this refuse matter for fertilizing purposes, and therefore, with this intent, he spread it upon his land in the neighborhood of his house. A few days afterwards an epidemic of diphtheria broke out in the family of the farmer and among the other villagers who lived in the immediate vicinity of the fertilized land. The epidemic spread so rapidly in the place that in the course of six months hardly one hundred persons could be found who had not had one or more attacks of diphtheria, and the death rate for the year was more than doubled.

In the beginning of the epidemic a certain quantity of unslaked lime had been thrown into the suspicious pool, and, at the same time, the tripe cleaner had changed his quarters and no more thought was given to him. This industrious individual, however, had not forsaken the country, but had moved to another part of the village where he began anew his work.

A few steps from his new house he had dug a ditch into which the water used for washing and cooking his wares was allowed to run, to collect, and to evaporate, when in rainy weather it did not over-

*Eulenberg's Real-Encyclopedie.

flow. Furthermore, this polluted water could slowly filtrate through the ground into a little pond which served as the public water supply. This went on for eleven years without the appearance of any epidemics until, in 1887, the same farmer who before had made this fertlizing experiment had the foolhardiness to clean out this ditch, and spread its contents upon the land in the immediate neighborhood of his house again, and with the same results. The epidemic this time spread rapidly.

Dr. Sternberg* has expressed the opinion that "it seems extremely probable that the diphtheritic poison—germ—is capable of increase, independently of the sick, in damp, foul places, such as sewers, damp cellars, and especially under old houses in which the floors come near the surface of the ground, leaving a damp, ill-ventilated space. At all events, the disease often clings to such houses in spite of the application of the usual means of disinfection. There is no doubt as to the influence of bad hygienic conditions in maintaining the infection when the disease has been introduced and it is possible that such conditions may, in certain cases, originated it.

The belief, however, in the exogenous multiplication of the diphtheria germ outside the animal organism must be considered as still theoretical, and should not be permitted to engross our attention to such an extent that we may become unmindful of the settled fact that diphtheria is an infectious disease.

Many of our medical correspondents accord filth and etiological relationship to diphtheria. Others do not believe that diphtheria is a "filth disease." Dr. J. A. Richards of Farmington, who probably, has seen as much of the disease as any one in the State concludes "that it is not a filth disease. In my experience it has prevailed more on high land than low."

Dr. Earle of Chicago, contributed to the Ninth International Medical Congress an interesting paper giving the results of his investigations as to the comparative prevalence of diphtheria in several cities and the newly settled portions of the western States in which sewers are unknown. He finds that this disease is as severe and fatal in the salubrious localities of the newly settled and mountainous States and Territories of the northwest, where it happens to be introduced, as in the foul air of the cities.

Almquist† of Goteborg, Sweden, one of the most acute observers of the continent says: "The conditions outside our dwelling houses appear to have but little to do, for sanitary improvements have shown no effect upon the disease."

*Lomb Prize Essay—Disinfection and Individual Prophylaxis against Infectious Diseases.
† Zeitschrift fur Hygiene, V. 28.

In the discussion before the Medical Society in Boston to which we have referred on page 236, Dr. C. F. Folsom formerly secretary of the Massachusetts State Board of Health spoke as follows:

The epidemic which reached its height in 1863 caused 2284 deaths in that year, decreasing 676 in 1870, and again rising rapidly from 913 deaths in 1874 to 3294 in 1876. The State Board of Health began the inquiry regarding the conditions affecting the spread of diphtheria with the usual pre-conceived notions of that time in favor of filth propagation, but the facts disclosed by several examinations showed that filth was a subordinate factor, and that infection was the chief element.

The investigation in all the towns of the State entirely corroborates Dr. McCollom's statement. I will mention only two towns. In 1874 the little town of Conway, of 1400 inhabitants, had 140 cases with between 70 and 80 deaths, a mortality of a little over 50 per cent. The houses were isolated, the people intelligent. Every single family was personally well known by some doctor, and the conditions for investigation could not have been better. It was a high town and well situated; a rapid river flowed through the bottom of it. There were four tenement houses in the town occupied by foreigners, and scarcely a case occurred there. There was an extremely filthy slaughter house in the town, but the houses near the slaughter house suffered less than the others, and the family actually lived in the same building with the slaughter house and not a single case occurred there. All the filth from the slaughter-house was carried to a large field and spread upon the ground, and the houses nearest it scarcely had a case. Almost every case could be traced to contagion or infection, whichever you call it. The primary source of infection, however, was not discovered.

In Gloucester there was quite a severe epidemic. That was deemed a very good place for investigation, considering the peculiarities of the town, which everybody knows; no sewers, no water supply, and the wells in a very bad condition. There were two hundred and eight deaths during four years, seventy-five in one year. Thorough examination of the sanitary condition was made, and every house where a case occurred was noted. The same facts were found there, and that the relation of the disease to filth was decidedly obscure, but the matter of contagion was a prominent one and the chief one. The wells were in the worst condition of any town in the State; the soil shallow, with rock underlying. In two wells I made a computation of the value of the drinking water as manure, and found it of precisely the same value as the sewage from the Pittsfield sewers. Two very large families habitually drank that water and not a single case of diphtheria occurred. I might give many towns where the same series of investigations were made with the same results.

AS TO THE IDENTITY OF CROUP AND DIPHTHERIA.

The State Board of Health of Michigan and of Iowa and some municipal boards of health have adopted resolutions to the effect that, for sanitary purposes, membranous croup shall be deemed identical with diphtheria, and that it be included in the list of contagious diseases. The following extracts from various recent sources have a bearing upon this question and will help us to form a judgment as to the correctness of the position taken by these sanitary organizations.

Virchow was the first who sought to bring order out of chaos by defining the difference between croup and diphtheria to be this: In the croupous inflammation the exudation of false membrane is upon the surface of sound mucous membrane; while in the diphtheritic inflammation the exudation extends into the very substance of the mucous membrane and leads to its destruction. This pathological distinction profoundly influenced medical opinion and perhaps in our investigations as to the identity or non-indentity of croup and diphtheria has had much to do with making us lose sight of the etiological part of the question.

In the words of Steiner,* "the attempt to distinguish croup and diphtheria as two entirely distinct diseases has been unsuccessful both from an anatomical and from a clinical standpoint; indeed there are many good reasons for supposing that these two affections are only varieties and modifications of one and the same process, which, in consequence of special influences and collateral causes, as yet imperfectly understood, makes its appearance at one time as croup, at another as diphtheria, now in a sporadic form, now as a widespread epidemic, now as a primary, and now, again, as a secondary affection."

Francotte declares that "the discussion as to the differentiation of croup and diphtheria in the form in which it was first given to us by Virchow, may be considered as ended." Again he says:

"If chemical and other irritants of different kinds are capable of giving rise to the formation of a false membrane in animals, what is more natural than to take it for granted that with the human subject a croupous inflammation independent of diphtheritic infection may be produced by the action of mechanical irritation or the action of cold. The possibility, therefore, of an inflammatory croup cannot be denied."

Is it possible, one would ask, to distinguish inflammatory croup from diphtheritic croup without evident infection? I should say, that the matter is a very difficult one, and that etiology and conta-

*Ziemssen, Vol. IV.

gion are the only means for distinguishing them. It becomes therefore, a matter of determining whether the croup has originated through contagion, and whether it is communicable, or whether the action of some other irritating substance can be shown to have probably occurred. This differentiation has only a theoretical value, for in reality it must be admitted that simple croup is almost always, if not constantly, diphtheritic.

The opinion of Senator* is: Many are of the opinion that the croupous inflammation of the air passages constitutes a disease by itself without any participation of the pharynx in the process and independently of diphtheria. This view cannot be shown as absolutely false, partly because in the earlier epidemics, and even until the middle of the present century, the affection of the mucous membrane of the throat from the beginning to the end of the disease was entirely absent, and partly because, according to the positive testimony of different investigators, it cannot be doubted that chemical irritants which have nothing whatever to do with diphtheria have produced a croupous inflammation of the air passages. The testimony of these investigators is not shaken by the negative results which have followed the experiments of others. Nevertheless, in by far the greatest number of all cases, at least, now-a-days, the croupous inflammation of the pharynx and trachea is the result of the contagion of diphtheria, and appears almost always only in epidemics of diphtheria or with other anatomical forms of the same disease. We therefore draw the conclusion that croup and diphtheria are only different manifestations of one and the same disease.

Liebermeister† tells us: "But the question is for us chiefly etiological and not exclusively anatomical, and what we want to know is, if the disease designated under the name of croup is caused by the same pathogenic agent as diphtheria."

The question of the identity or otherwise of croup and diphtheria, especially from the pathological point of view is well summed up by Wood and Formad.‡

Diphtheria and pseudo-membraneous croup are considered totally distinct diseases by the majority of clinicians. Some admit a diphtheritic croup, which is to be distinguished from inflammatory croup.

The results of experiments (which will be detailed in another chapter) and careful studies of the anatomy of the lesion do not justify the above distinction. It will be shown that the morbid process which gives rise to the respective lesions in the pharynx and in the air passages is the same, and the anatomy of the products identical.

It is easy to demonstrate that the apparent difference in the lesions of diphtheria and the pseudo-membraneous croup, and the morphology of the exudates is altogether conditioned by and de-

*Volkmann's Sammlung klinischer Vortrage Nr. 78, quoted from Minnich.

†The Infectious Diseases, Detroit, Mich. 1888.

‡Report of the National Board of Health, 1881.

pendent upon the anatomical peculiarities of the pharynx and respiratory passages; and more so yet by the degree of affection.

The submucous tissue of the pharynx is made up of a loose, highly vascular connective tissue which does not restrict the congestion of the vessels and the extravasation of the corpuscular elements. At the same time, however, the rapidly coagulable exudate only partly reaches the surface of the mucous membrane, the bulk of it being kept below by the heavy layer of stratified epithelium.

The submucous tissue of the trachea, on the other hand, is made up of a dense, elastic tissue and a less vascular tissue, backed by the avascular cartilagenious rings. Hyperaemia and extravasations from the vessels are here limited and only severe inflammation will give rise to exudates which are rapidly expelled to the surface by the dense matrix, and meeting with no resistance on the part of the single layered epithelial covering, coagulate mostly on the surface. Again, the mucous membrane of the fauces and mouth has a squamous not easily detached epithelium, and consequently membrane connected with or springing from such surface is firmly adherent. The epithelium of the trachea is columnar, ciliated, and detaches with the utmost facility, even in normal conditions of the organ; hence, membrane attached to it separates readily. The membrane of diphtheritic trachitis is always readily detached in the line of the epithelium.

This detachment is, according to Rindfleisch, further facilitated by the excessive secretion of the tracheal glands, the liquid forcing itself between the mucous surface and the pseudo-membrane.

Several Maine physicians have contributed observations bearing upon the question at hand.

Dr. G. A. Wheeler, Castine —In nearly 30 years of practice I have never had or seen a case of membraneous croup that was non-diphtheritic.

Dr. A. K. P. Meserve, Portland.—About 1870 I saw a case of membraneous croup in a girl some five or six years old. The case was a typical one, without any suspicion of diphtheria and ran a rapid course terminating in death. About ten days afterward a sister, the only remaining child was attacked with well marked diphtheria. The glottis was attacked early and the child died with diphtheritic croup.

Dr. Enoch Adams, Litchfield.—A case of fatal membraneous croup was reported in a family that moved to our place, about two weeks after the death of their child and within ten days after the moving, a severe case of diphtheria appeared in an older boy of the family. I did not see the case of croup but always had a suspicion that in the moving the change of bedding brought the contagion to the bed of the second child.

Dr. C E. Proctor, Weld.—Membraneous croup occurred in the fall of 1887, all the cases of which, I believe to have been diphtheritic, from the fact that two or more in the same family would

be taken, one with the laryngeal obstruction from the first while the others would be well marked cases of diphtheria. In the family of Mr. C. a youth of eighteen years died of diphtheria, and an infant belonging to the daughter of Mr. C. took membraneous croup and died.

Cases of diphtheria also occurred a little later in the family of Mr. D. who had visited frequently the family of Mr. C. during sickness in the latter period. The youngest child of Mr. D took diphtheria and died in less than a week and an older child had diphtheria which assuming the croupous form ended fatally.

The following interesting information in regard to recent experiences with croup in Waterville has been sent by Dr. F. C. Thayer, Health Officer of that city:

Case 1. On April 1st, 1889 there occurred a fatal case of membraneous croup. A lady who assisted in the care of the little patient returned to her home and within two weeks she lost a child of membraneous croup.

Case 2. About the first of May a girl five years old, died of membraneous croup in a house where, within seven years, there had been at least five cases of diphtheria, one of which was fatal. A sister of this girl visited and played with a little two-years-old boy who, very shortly thereafter, sickened, and directly a well marked membraneous croup was present.

Case 3. An aunt of this boy came from an neighboring town to assist in taking care of him. Within a few days she developed a complete diphtheria from which she had quite a protracted convalescence.

The writer of this, firmly believing at that time in the dualism of croup and diphtheria, had the following personal experience: A child of eight died after a tracheotomy of what appeared to be simple membranous croup. During the sickness of this child, a friend of the family, a lady who had a boy of two years and a half at home, was quite assiduous in her help and consolation to the afflicted family. The child of this lady came down with the same disease a few days after the death in the first family. In neither case could false membrane, inflammation, or other trouble be detected in the pharynx.

In another instance, being called to a child four years old who for two or three days had suffered from a gradually progressive difficulty of breathing, he advised the mother to send for the father, who was absent, as the little girl would probably die before morning. There were none of the characteristics of pharyngeal diphtheria to be detected upon careful examination, neither was there any history of any preceding soreness of the throat. The father

came home, but the child did not die. At midnight she had a spasm of coughing, became black in the face, and finally coughed up a membranous cast of the larynx, which never reformed. The father, however, a man of about twenty-eight years, had within a few days an attack of malignant diphtheria but recovered. There was no discoverable source of infection for the father, unless we may regard the croup of his child as such.

The relation between croup and diphtheria was investigated by Dr. Lennander,* by carefully finding out, whenever a case of croup came to his notice, whether cases of diphtheria had also occurred, either previously or subsequently, in the same house or in the same neighborhood. In this way he was repeatedly able to connect a case of croup with a case of diphtheria. In all cases in which he tracheotomized for croup, and in which there was no deposit upon the pharynx, he was either able to demonstrate with positiveness a relation to diphtheria or to show that it was highly probable. In the greater number of cases it was believed that secondary croup also depended upon diphtheria.

The author nevertheless believes that all cases of croup are not etiologically the same.

In a discussion on diphtheria which took place before the Suffolk District Medical Society, January 19, 1889,† Dr. Durgin, chairman of the municipal board of health said:

The cases are numerous where the cases have spread from one person to another in the family, and beyond the family, while the physician has persisted in calling it croup, and therefore, not contagious.

Dr. Marion in reference to the same subject spoke as follows: Another subject that Dr. Durgin has alluded to is with reference to croup. I suppose that that is, and always will be, a disputed point. I don't know that croup is not diphtheria; and there are some cases that certainly don't get reported as diphtheria. A case that has recently occurred in the ward might illustrate what I mean. The children were all sick with measles under the care of a physician practicing sectarian medicine. This child after going through the measles was attacked with croup. The child had the operation of intubation and died within twenty-four hours; was allowed to have a public funeral, was embalmed and had a "wake." Two days after the funeral the remaining two children of the family were sent to the city hospital by my brother. On the following day I sent the woman to take care of a child during the intubation, and subsequent to that there were several cases of diphtheria, but still the first case was claimed to be a case of Simon-pure croup. I fancy

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*Archives of Ped. from Jahrb. f. Kinderk.

†Boston Med. and Surg. Jr. Mar. 14, 1889.

that often times it goes that way. In connection with diphtheria it was my fortune to see several cases of diphtheria following croup.

Dr. I. N. Love* thus states his present position as to the identity of croup and diphtheria:

During the earlier years of my professional life I was uncertain in my position; after reading the views of Virchow, Cohen, West, Flint, and others as able, I was inclined to take a position in the ranks of dualists. Severe scrutiny of the products of the pen of Bretonneau, Traube, Barthez, Sanne, and the tribe of unicists, left me inclined to favor their position, but special clinical opportunities and additional arguments of later watchful workers and able annaists like Jacobi and Struempel have enabled me to crystallize my convictions and prompted me to take a position positive and pronounced in favor of membraneous croup and diphtheria being identical.

In a recent communication Dr. G. Leibmann† writes:

It is certainly a surprise to see how tenaciously the profession on this side of the Atlantic still adheres to the dualistic view on this subject, while the authorities in Germany more than three years ago passed their final verdict that croup and diphtheria are one and the same. . . . .

Now with these few lines the writer wishes merely to direct the attention of the profession to what is at present considered the final and almost universally accepted view of the German authorities as to the relationship between croup and diphtheria.

Strumpell says: . . . . . "An essential difference between croup and diphtheria there is not; the diphtheritic inflammation is the graver form, the croupous the milder. In the first we have preceding the fibrinous exudation, to deal with a necrosis of the epithelium and the subjacent mucous membrane tissue, in the second (the croupous form) only a necrosis of the epithelium.

In practice generally the physician calls those cases membranous croup in which he can detect no pseudo-membrane or other symptoms characteristic or suggestive of diphtheritic inflammation in the pharynx, and those cases diphtheria, or diphtheritic croup, in which he is capable of demonstrating false membrane in the throat or nasal passages. How uncertain a diagnostic point this is we may judge by the following from Francotte.‡

Henoch recognizes the existence of a primary, not infectious, croup which seldom appears, and warns against the possible error of overlooking the diphtheritic throat trouble. He cites the case of a maiden whose pharynx appeared to be entirely unaffected, while at the autopsy, on the posterior surface of the soft palate, a diphtheritic infiltration was found. The same author describes also two other analogous cases.

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*Jr. Amer. Med. Assoc Nov. 24, 1883.

†Boston Med. and Surg. Jr. April 11, 1889.

‡Die Diphtherie, German translation by Spengler.

Sanne also draws attention to the existence of diphtheria in places beyond the range of ocular inspection. "In one case of croup in which, before death, in spite of careful inspection, no diphtheritic inflammation of the throat could be detected, I found after death pseudo-membrane on the posterior wall of the tonsil and extending itself towards the larynx. The anterior surface of the tonsil, as well as the arches of the palate, were entirely intact."

Yes, there are cases of croup in which infection is not present, or at least not discoverable, in which but little complaint is made of general disturbances, in which the swelling of the glands and albuminuria are not present. But have we not to do here with mild forms, "*formes ebauchees*," to use the expression of Guerin, as they appear in all infectious diseases. Scarlet fever does not cease to be scarlet fever because the rash has been slight or fleeting, or because it has entirely failed. Do not the cases in which the general symptoms are not well marked belong to scarlet fever as well as those in which the symptoms are marked by great irregularity? Are not variola discreta, v. confluens, modified small-pox, or varioloid, only varieties of the same disease? How many grades there are in typhoid fever, from the most irregular acute form to the walking cases? Are not measles, puerperal fever and other specific diseases characterized by like differences? Does not cholera in times of epidemics restrict itself with many persons to a profuse diarrhœa?

Between the mild forms of diphtheritic laryrgitis (croup) to the exquisitely infectious forms of diphtheria, there are innumerable transitional forms and the diagnostic creteria which are given are of but little worth.

The writer of this while not denying the possibility of a form of croup due to meterological conditions or to irritants other than the diphtheritic poison, believes that nearly all, and perhaps all, cases of membraneous croup are diphtheritic in their origin and nature. Admitting, if we must, a membraneous croup with no etiologocal relationship to diphtheria, the want of any trustworthy diagnostic marks by means of which we may distinguish such cases from those which are diphtheritic, would compel us, as the only safe course, to regard all cases of membraneous croup as cases of diphtheria, from a sanitary point or view, and to treat them accordingly, especially when diphtheria is prevalent.

THE CAUSES OF DIPHTHERIA.

Diphtheria is a contagious* disease, therefore with our present conception of the nature of the communicable diseases we naturally refer the origin of a given case of this disease to a probable source

*See the word "Contagious" in the Glossary.

of contagion immediate or mediate, near or remote as regards time and distance.

Season, geographical position, filth, poverty, and overcrowding, often classed with the causes of diphtheria, may probably all be retained as predisposing causes. They are conditions which, in one way or another, influence the spread or development of the essential cause, the contagion, or increase personal susceptibility to it.

The essential cause of diphtheria, believed by most authorities to be specific, is the contagion. The contagious principle in a considerable number of infectious diseases of man and animals has been discovered, and biological studies of them more or less complete have been made. In all cases in which the infectious element has been isolated and its nature determined, it has been found to consist of a parasite, a microscopical organism, endowed with the power of multiplication. Many thoughtful students of the disease in question have been impressed with the conviction that diphtheria likewise should be classed as one of the bacterial diseases.

Many investigators have busied themselves with studies as to the bacteriological nature of diphtheria, but the results only of those more recent investigators who have employed the methods which are laid down by Koch are trustworthy.

Klebs, after a half score of years discovering diphtheritic microbes, described at the medical congress of German physicians at Wiesbaden in 1883, a bacillus which he had found in the false membrane in an outbreak of diphtheria which he had lately investigated. In the discussion which followed Dr. Edlefson of Kiel affirmed that he had also frequently found the same bacillus in the false membrane of diphtheritic patients.

In 1884, Loeffler gave the results of his studies of the same bacillus in the Report of the Imperial Board of Health* of Germany. He found in the diphtheritic membrane two principal forms of micro-organisms,—one, a streptococcus, or micrococcus arranged in chains (*kettenbildenden Micrococcus*) another, a bacillus, or rod bacterium, supposed to be identical with the Bacillus of Klebs. The former, the streptococcus, was cultivated and the pure cultures inoculated upon various animals. Several times in rabbits, after injection beneath the skin, an erysipelatoid inflammation occurred and a purulent infiltration of the joints, but in no case were symptoms produced resembling those of diphtheria.

*Mittheilungen aus dem Kaiserlichen Gusundheitsame. Band 2.

It was otherwise with the bacillus. Loeffler admits that in a few typical cases of diphtheria he was unable to find the bacillus of Klebs and surmises that the micro-organisms might have been present earlier in the disease and might have been eliminated before death occurred.

The bacillus was found only in the false membrane or upon the parts which were affected with the diphtheritic inflammation, and he says that "in the remaining organs, in the heart, spleen and kidneys, I have sought in vain for the bacilli." Pure cultures inoculated upon rats and mice showed these animals to be completely immune.

Guinea pigs without exception, when inoculated subcutaneously with the pure culture of the bacillus, died after an average period of two days. In all these animals a grayish-white exudation appeared at the point of inoculation and a subcutaneous œdema spread itself from the point of injection. The bacillus was found in nearly all the cases reproducing itself at the point of inoculation, but in no single case could it be found in the internal organs. Loeffler concluded, therefore, that the bacillus multiplies only at the point of inplantation where it produces a chemical poison which brings about the general symptoms and the death of the animal. He nevertheless thinks that the strict proof that this bacillus is the cause of diphtheria had not been furnished. In a later communication (1887) he reported finding the bacillus without exception in ten recently examined cases of diphtheria.

Since the publication of the result of Loeffler's investigations it has been quite widely accepted as probable that the Klebs-Loeffler bacillus is the essential cause of diphtheria.

Last year (1888) Roux et Yersin reported in a paper in the *Annales Pasteur* the results of their investigations as to the relation of the Klebs-Loeffler bacillus to diphtheria and the following abstracts are translated from a resume of this paper which is given by Thoinot and Masselin.*

M. Roux et Yersin have shown that the pure cultures of the bacillus when placed in contact with the excoriated mucous membranes of certain animals, give rise to a diphtheritic false membrane.

That subcutaneous inoculation, intravenous injection and injection of pure cultures into the intra-peritoneal cavity kill the animals which are the subjects of the experiment.

That experimental inoculations of pure cultures are capable of producing diphtheritic paralysis.

* Precis de Microble Medicale et Veterinaire, 1889.

That in excoriating, with a platinum wire charged with the culture, a mucous membrane, whether of the pharynx or of the conjunctiva, whether of rabbits, guinea pigs, pigeons, or hens, the diphtheritic false membrane is produced.

A curious experiment consists in tracheotomising a rabbit and, by means of the platinum wire, inoculating some of the culture upon the mucous membrane of the trachea. The result is the development of the false membrane in this region, and the fatal issue is the rule, with symptoms of mechanical obstruction, like those in croup in the human being.

The guinea pig is found to be very susceptible to the diphtheritic infection. It succumbs to the subcutaneous inoculation of small doses and presents at the post mortem examination the following lesions: A gray membraneous exudation limited to the point of inoculation. A gelatinous œdema more or less extended, congestion of the lymphatic glands and the internal organs, especially of the supra-renal capsule, serous effusion into the pleural cavities and hepatization of the lung tissue.

After death from diphtheria in the human subject the bacillus is found only in the false membranes from which alone cultures can be made. The blood and internal organs never contain the pathogenic agent. The same fact, so interesting and so important, is found in experimental diphtheria.

When the bacillus is inoculated under the skin of the guinea pig it multiplies only at the point of inoculation, in the gelatinous oedema which develops here.

When the pure culture is injected into the veins of the rabbit, death is the rule, in less than sixty hours.

The microscopic examination of the blood or of the internal organs of the rabbit which succumbs to intravenous injection does not reveal the microbes.

Injections of the pure culture into the peritoneal cavity kills the guinea pig, but less rapidly than inoculation beneath the skin. The peritoneal liquid of the animals which succumb, and it alone, contains the bacillus.

The experimental re-production of diphtheritic paralysis is one of the most interesting points in the work of M. Roux et Yersin. "Paralyses," they write, "are observed in animals inoculated with diphtheria, whether in the trachea or under the skin. It is a very frequent phenomenon when the animals do not succumb to a too rapid poisoning.

The first case of experimental diphtheritic paralysis was observed by them in a pigeon which, inoculated in the pharynx, had had a typical formation of false membrane and appeared to be recovering.

When rabbits are inoculated in the trachea and survive the earlier symptoms of diphtheria they very often present the symptoms of paralysis which leads to a fatal issue.

The paralysis usually begins in the posterior quarters and sometimes it is so rapidly progressive that, in one or two days, it has invaded the whole body; and that the animal dies by interference

with the respiration or by arrest of the action of the heart. At other times, the paralysis remains limited for a certain time to the posterior limbs and begins with a weakness of the muscles which gives to the gait a peculiar appearance; then it becomes more complete, and the movements of the fore quarters are alone retained.

The paralysis almost always reaches the anterior limbs and the neck and becomes general. It is not rare to see death supervene suddenly without convulsions, surprising the animal in the attitude in which it happened to be a few instants previously.

The Diphtheritic Poison. In man dying of spontaneous diphtheria and in animals killed by experimental diphtheria, the bacillus multiplies only at a single point: in the false membrane in man, the place of inoculation in the animal. In animals subjected to intravenous inoculation this fact is more clearly shown. The bacillus has completely disappeared from the blood after some hours, and nevertheless the disease continues its course; it kills with or without paralysis. What then is the cause of death in this disease, where the fatal termination and the characteristic sequels of paralysis cannot be attributed as in anthrax, etc., to the multiplication of the bacillus? This factor is the *diphtheritic poison*. M. Roux et Yersin have rendered this poison *tangible*, so to say, and with it they have killed and paralyzed their experimental animals.

"We filter through porcelain," say these authors, "a culture in veal bouillon after it has remained seven days in the oven; all the microbes are retained by the filter, and the liquid which we get is perfectly limpid and slightly acid. It contains no living organism. Left in the oven it does not become turbid; added to sterilized alkaline bouillon there is no growth of bacteria; introduced beneath the skin of animals in doses of from two to four centigrams it causes no illness. It is otherwise however, if we use larger doses, if for example we inject 35 centigrams into the peritoneal cavity of a guinea pig or into the veins of a rabbit.

The guinea pig becomes ill after two or three days and dies about the fifth or sixth day with swelling of the lymphatic glands and dilatation of the vessels, congestions of the internal organs, especially of the kidneys and supra-renal capsules.

In the rabbit which has received in his veins 35 centigrams of the filtered liquid, there supervenes about the fourth or fifth day a paralysis of the posterior extremities which rapidly becomes general and kills the animal.

Old cultures contain the poison in greater abundance than new cultures, and the toxic effects of it are rapid and terrible. A rabbit which receives 35 centigrams of the filtered culture liquid 42 days old becomes sick in about two hours, and succumbs in five or six hours to a profuse diarrhoea and great difficulty of breathing. A guinea pig which receives the same quantity of the same poison in the peritoneal cavity dies in ten hours with an intense dyspnœa. The post mortem appearances are those we have described above.

Let us introduce under the skin of a series of guinea pigs the poisonous liquid freed from the living microbes in quantities vary-

ing from one fifth of a cubic centimeter to two cubic centimetres, and compare the effects with those of a series into which the fresh culture of the bacillus of Klebs has been introduced.

All the animals which have received the filtered liquid soon present an œdema at the point of injection; their hair becomes rough or bristling and they have a panting respiration like those which have received the culture which has not been filtered; like them also they die, presenting meanwhile no points of difference as regards their symptoms. The disease, symptoms and lesions are produced just as surely by the injection of the poison as by the inoculation by the bacillus.

The rabbit, like the guinea pig, succumbs to subcutaneous injection of the toxic products and the lesions are the same as those which follow the injection of the living culture.

Those animals (rats and mice) which are refractory to the inoculation of the living culture are also refractory to the diphtheria poison.

The injection into animals of variable doses of the soluble poison of diphtheria shows us diverse forms of diphtheria poisoning, from those which produce death in a few hours to those which bring on, after a shorter or longer time, paralysis which finally causes the death of the animal or ends in recovery.

This delayed action of the diptheritic poison is well known in clinical experience, and its explanation is obscure.

Let us sum up in brief the etiological and pathological data which the memoir of MM. Roux et Yersin have given us.

Diphtheria appears to be capable of attacking only mucous membranes which are despoiled of their epithelium or which are not healthy. The bacillus acts upon the organism only at a distance, remaining exclusively localized in the false membrane and affecting the system by its toxic secretion, by its poison in a word. It is to this poison we must attribute the rapid death of malignant cases, and it is to this factor also we must attribute the diphtheritic paralyses, immediate or delayed. It is this poison, finally, which, impregnating the organism, marks its presence by those internal congestions, that condition of the blood, etc., which one finds at the autopsies, as well in spontaneous diphtheria as in experimental diphtheria.

Still more recently Kolisko and Paltauf, in the *Wiener Klinische Wochenschrift*,* have given the results of their investigations into the nature of croup and diphtheria. Their researches have extended over a period of more than two years, and they found the diphtheria bacillus of Loeffler in about fifty cases of the different forms of the disease—in nasal and pharyngeal diphtheria, in croup of the larynx and the trachea accompanying diphtheria or occurring independently of it, in diphtheria and croup secondary to scarlatina and measles, in children and in adults, in the sick as well as at the autopsy, and

* Centralblatt f. Bacteriologie u. Par., May 24, 1889.

also in one case of diphtheria of the conjunctiva. The authors failed to find the bacillus only in the later stages of the disease.

The fact should be noted that the Loeffler bacillus was found in so-called cases of pure croup, and therefore they regard the disease of the throat (diphtheria) and that of the larynx (croup) as etiologically the same.

Sternberg says,* adverting to the work of Roux and Yersin. "Our authors claim that this evidence completes the resemblance of the experimental malady produced by inoculations with this bacillus, to the natural malady, and establishes the specific role of the bacillus of Klebs and Loeffler. Without going quite so far as this we say that the evidence seems to us to give strong support to this conclusion."

Dr. Prudden† of New York has arrived at different results in a series of investigations which he has carried on as to the nature of diphtheria. In twenty-four cases which he examined he was unable to find the bacillus of Loeffler, and the only species of bacteria present in the pseudo-membrane in nearly all his cases was a streptococcus which morphologically was not distinguishable from the streptococcus of erysipelas.

PNEUMONIA AS AN EPIDEMIC OR INFECTIOUS DISEASE.

The physician sometimes encounters in practice a series of cases . pneumonia in the same family, or in persons who are closely associated, and occasionally the individual attacks succeed each other in such order and under such circumstances that, to the medical attendant, or even to the general public, the possibility of infectiousness suggests itself. A few such observations of recent date have been communicated to this office by physicians of this State.

We are under obligations to Dr. O. H. Merrill of Corinna for the following:

April 24, 1888, W. J., male, about 60, was attacked with typical croupous pneumonia. His sister came from Massachusetts and was in attendance upon him. May 1st she also had typical pneumonia. Four days later another sister who was in attendance upon both the other cases was attacked. There was no possible doubt as to diagnosis. The first two cases occurred in persons of feeble

*Brooklyn Medical Journal March 1889.

†The Am. Jr. Med. Sciences, April and May 1889.

health. The first case was in a man who had chronic rheumatism and heart disease. The second case had, to say the least, a marked tendency toward phthisis. The third case occurred in a woman of about fifty-eight, who was presumably well before. Those are the facts. I presume you do not care for any further comment, so I will refrain from further remarks. Most assuredly, however, the facts do not *prove* contagiousness, but do they not suggest it?

The next is from Dr. Henry B. Palmer of Phillips:

In April, 1887, I attended a family in Sandy River Plantation. The family consisted of three old people between seventy and eighty years of age, and a young man of about thirty years. One of the old people had died about a week before my first visit, but from description of symptoms had undoubtedly had pneumonia. The other two old people were both taken sick the day of the funeral. One had a simple pneumonia and the other had typhoid symptoms. Of these, one died and the other lived. In about two weeks after this, the son was attacked with the same disease, but recovered. Also a man who came there to assist the family was taken sick in about a week and died. The house where this sickness occurred was situated on the shore of one of a chain of ponds which at this time of the year are very full from the snow melting from the mountains. This may have been the cause, or it may have been from infection. I also attended a person in a family the present winter in which five persons had pneumonia in succession, with two deaths. In this instance I could discover nothing in the sanitary condition of the place which would explain.

Dr. H. F. Twitchell of Freeport writes as follows:

In the winter of 1886–7, I attended about fifty cases of pneumonia. I can attribute the unusual prevalence of the disease to no cause excepting great and severe change of temperature, or to some unusual condition of the atmosphere. Two ladies were attacked about the same time who lived close together. A neighbor who came to nurse one of these patients for three days went home and at once had pleuro-pneumonia. Her place was taken by two sisters of the first patient, one from Brunswick and one from Yarmouth. In a few days after their arrival both these sisters were attacked with lobar-pneumonia within twelve hours of each other. This suggests infection.

Dr. David Dana Spear of the same town writes of about twenty cases of pneumonia which occurred the same winter at a locality about three miles from Freeport village.

The cases were all on low land traversed by a small river or large brook, and were confined to families who visited each other frequently, thus suggesting contagiousness. Observations of this kind have not been wanting in my practice during the last twenty years, and I can hardly doubt the infectious nature of pneumonia.

Dr. J. O. Webster, member of the State Board of Health, being personally acquainted with some of the following facts obtained the remainder of them from the sister of the first case:

Case 1, was taken sick in Boston, May 4th, 1886. On the following Friday he started for his home in Vassalboro. Arriving in Augusta, he was not able to travel further, and a physician was called who pronounced the case pneumonia. The patient died May 19th.

Case 2. The father, always an exceptionally strong man was with his son in Augusta during his illness, and was taken down with pneumonia May 27th, and died June 5th.

Case 3. A brother of Case 1 came on from Wilmington, Del., to attend the funeral of his brother. He came down with pneumonia June 3d, and recovered after a lingering sickness of about three months.

In the latter part of March and the early part of April, 1889, a localized epidemic of pneumonia occurred in the town of Weld. There were in all eleven cases, of which four proved fatal. The fatal cases all died on the fourth day of illness.

Case No. 1. A man of 42. He died on the fourth day.

Case No. 2. A young man 22 years old, son of No. 1 and in same house; recovered.

Case No. 3. A man 27 years of age, brother of No. 1; first house north; recovered.

Case No. 4—Second house north from No. 1; a man 32 years old; convalescence protracted.

Case No. 5. Brother of No 4 and lived in same house with him; 30 years old; recovered.

Case No. 6. Boy of 10 years; recovered. His mother went to nurse cases 1 and 2, taking her son along with her. While there the boy became sick and was carried to his home, the first house south of No. 1.

Case No. 7. A boy of eight years; recovered; second house south of No. 1. The mother of this boy went to help at the house of No. 1 and 2 during their sickness. going back and forth between the two houses.

Case No. 8. A woman about 50 years old; was at the house of Nos. 1 and 2 nine days watching every other night and helping in the washing. Came down with pneumonia and was carried to her home, outside of the neighborhood in question. Died on the fourth day.

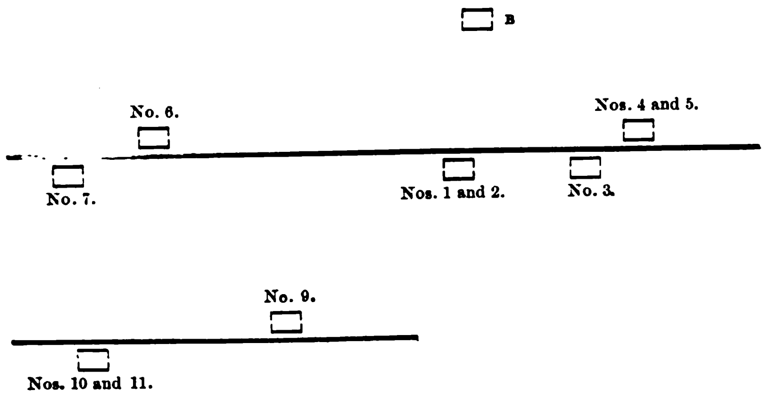
Case No. 9. A widower of 45; lived alone across the field from where Nos. 1 and 2 lived; came to their house frequently during their sickness; severe case; recovered.

Cases No. 2 to No. 9 inclusive were all taken sick soon after the illness of Nos. 1 and 2, and about the same time, and had all been

in and out during their sickness, or had help to attend them. They all lived quite near to the house where the first case occurred except No. 8 who came as nurse.

Case No. 10. The mother of No. 9 went to care for him during his sickness, took the disease and died on the fourth day.

Case No. 11. A married sister of No. 9, became sick two days later than her mother, No. 10, and died on the fourth day of her sickness. She had attended her brother.



During this outbreak every house in this little neighborhood had one or more cases of pneumonia excepting the house B, situated about 25 rods from the road opposite the house in which the first cases occurred. This family kept away and did not visit Nos. 1 and 2 during their illness. There was but one other case of pneumonia during the spring in the whole town. The land in the neighborhood which was affected lies low and is wet. The situation of house B is slightly more elevated and near the shore of Webb's Pond. The above facts were communicated by A. B. Russell, Esq., Clerk to the Secretary of State, who is intimately acquainted with the persons, the circumstances, and the locality. The ages are approximations.

Histories of epidemic or infectious pneumonia, or of several associated cases, are quite frequent of late in our medical and sanitary literature and the following are some which have come under my notice:

Dr. A. R. Matheson* reported before a meeting of the Medical Society of the County of Kings, March 20, 1888, the history of

*Brooklyn Med. Journal, Vol. 1, p. 314.

three cases of double pneumonia in the same family. The patients, children of eight, six, and three and one-half years respectively, were all attacked about the same time and all during the night of February 25. The reporter could find no probable cause except an old sheet iron stove which allowed the gas to escape.

In the discussion which followed Dr. Jewett referred to a somewhat similar experience which occurred in his own practice.

"An elderly woman from Canada, who had come to New York for the purpose of 'doing the city,' fell sick, after a few days, with pneumonia. Her daughter was sent for to assist in the nursing. Three days after her arrival she lay down beside her mother with pneumonia of the same lung and the same lobe.

Dr. Minard said that for some time he had been under the impression that pneumonia might be contagious and mentioned two cases of pneumonia under his treatment both of which were trained nurses, and both of which had been nursing cases of pneumonia.

In the early part of the year 1888, a remarkable epidemic of pneumonia occurred in Middlesbrough, a North England town of about 40,000 inhabitants, in which 367 persons lost their lives. Of these deaths not less than 288 occurred among males. The Local Government Board sent their inspector, Dr. Ballard, to investigate the epidemic and in his report he says that "the clinical features of the disease are, generally, sudden attack, rise of temperature, pain in side, rapid pulse and breathing, usually vomiting and diarrhœa, delirium, accompanied or soon followed by the physical signs of pleuro-pneumonia. The expectoration is at first 'rusty,' but afterwards of a prune-juice character. The fresh lung juice has been examined by Dr. Klein, who finds in it a hitherto undescribed bacillus, which he regards as specific. In the fatal cases death occurred often in from three to five days. The post-mortem appearances were those of lobar pneumonia, with invariable effusion of lymph on both costal and pulmonary pleura, coagula in the heart, apparently of ante-mortem formation; the spleen invariably pulpy, and ecchymoses of the mucous membrane of the stomach. Dr. Ballard regards the disease as a specific febrile one, and *infectious*."*

Dr. Mosler† reports four cases of pneumonia all occurring in the same family.

*Lancet, Vol. I, 1889, p. 742.

†Deutsche Med. Woch. XV, 245.

January 22, 1889, Arbeiter Drichel, aged sixty years, died at his own residence of acute inflammation of the lungs after five days sickness. The patient was under the care of another physician the first four days. On the day of the death of her husband Frau Drichel, a healthy woman of fifty-seven years, was attacked. She also died on the fifth day. During the illness of his parents August Drichel, a coachman thirty years of age, came to see them often and sat much at their bedside. Hitherto he had always been well. He took the disease Jannary 26 and died on the twelfth day. The daughter of the parents, who lived in another town, came to her father's house on the day of his death and remained there three days. Returning home she called a physician to attend her with pneumonia on the 29th.

An examination of the sanitary conditions of the dwelling house of the father convinced Dr. Mosler that nothing as regards its sanitary condition could have given rise to the outbreak. Within the last five years there had been no serious sickness in the house and especially no cases of inflammation of the lungs. In the house also where the son was at service no inflammatory diseases of the lungs had occurred during the last ten years; therefore, he thinks that the endemic origin of the disease as the result of the infection of the dwelling house can be excluded pretty confidently, and he believes that the father must have become infected outside his household, and that the other members of the family were infected by him. He thinks that the spread of the infection was favored by the practice of the patients in receiving their sputum in pocket handkerchiefs, and he further remarks that at the time of the death of the father, the mother and the daughter frequently kissed him.

"Dr. F. Trossat describes in the *Lyon Medical*, December 18, 1887, an epidemic of pneumonia occurring in Chalon-sur-Saone, which well illustrates the infectious nature of the disease. There has been considerable pneumonia in the department during the months of February, March and April, but the cases were so scattered that no contagious influence could be determined. The first case in this village (St. Loup de la Salle), was a child of five and one-half years, taken sick February 26th. March 7th, children in four different families were taken sick with the same disease. March 9th, three more cases occurred, and on the 11th, one more. All these nine children, aged from two to six years, went every morning to a sort of day-nursery where they stayed till 9 p. m. For more than a month there had been no case of pneumonia in the village. Nine out of twenty-five children occupying this one room

were attacked; but the epidemic did not extend to the other children of the school, occupying an adjoining room, nor did any of the little patients convey the disease to their parents, their brothers or their sisters." *

Catani's† observations in Naples leads him to believe that some outbreaks are infectious. He had seen seven persons in one family all take pneumonia, the one after the other. In another family, he had seen four children, one after another, take the disease. After the first case began to improve and the second child was attacked, the other two children were sent into the country, but both had pneumonia, one in two weeks and the other a little later.

Dr. Kühn‡ gives the following account of an outbreak of pneumonia in Moringen:

A man 76 years of age, living with his son in a well constructed and healthful house, was taken in November 1885, with a pleuro-pneumonia of the lower lobe of the left lung, and three days later his wife, a woman of 72, who had slept in the same bed with him, was seized with a double pneumonia. She died on the second day of her sickness, while her husband died the next day afterward, that is, on the sixth day of his sickness. The daughter aged 40 years, living in another part of the village, came to see her parents and watched with them nights. She took pneumonia and also died. The son with whom the aged couple lived, was seized with a chill on the day of the burial of his parents, and his temperature went up to 40.8° (105.4° F.) Under active treatment the temperature the next day fell to 37°. About the same time his child, six months old, was attacked with violent convulsions, and with an elevated temperature developed a catarrhal pneumonia which ended in recovery. Dr. Kühn thinks that the last two cases were due to the same infection as in the three which proved fatal.

The following facts are taken from a late paper on *Die Ætiologie der fibrinösen Pneumonie* by Dr. A. Seibert of New York.§ Most of the outbreaks to which he refers have occurred within ten years.

Kuehn first described an epidemic which broke out in a prison in Moringen in 1875. The cases were mostly of the nature of pleuro-pneumonia frequently complicated with pericarditis. In 1877 Mueller gave the history of an outbreak of pneumonia which affected three out of the four inhabitants of a small house and also two visiting relatives. In the same year, Richter gives the history of five cases of pneumonia which occurred within five days in the same house, and also of two other persons who had remained in the suspicious room. Dielinski reported nine cases of pneumonia among ten of the occupants of

*Boston Med. and Sur. Journal, Vol. CXVIII, p. 55.

†Deutche Med. Woch. XV, p. 276.

‡Ann. D'Hygiene Publique, XX, 182.

§Medicinische Monatsschrift, I, p. 67.

a house of two rooms. The cases all occurred within two weeks. He saw two cases of pneumonia in the house within two or three days. After a lapse of five weeks another family moved into this house and eight days later the wife came down with pneumonia. According to Germain-See, three out of five children in a family became sick with pneumonia within a few days. Daly reports six cases of pneumonia among eight persons inhabiting one house. Patchet narrates the death of a whole family within two weeks of pneumonia. The family consisted of three brothers and one sister, all adults. Kerschensteiner describes an outbreak of pneumonia which occurred in a prison in Amberg in 1880. From January to the middle of June, among 1150 prisoners, 161 had pneumonia of which 46 died. Holwede and Muenik reported an outbreak of pneumonia in a village of 400 inhabitants in which within thirteen days fifty children between the ages of one and five years became sick with pneumonia. Penkert reported an epidemic in a village of 700 inhabitants in which, from the 28th of March to the 28th of May, 42 cases of pneumonia occurred, thirteen of the cases being among the scholars of the village school, and of these, twelve sickened within the first fourteen days; and during these two weeks, four other children in the same families took the disease. Von Dusch describes a pneumonia epidemic which occurred in a village near Heidelberg. From the 16th of December 1883, to the 10th of April, the following year, or in about four months, forty-two persons in a population of 2,600 had pneumonia. Of these, thirty-four were children under fifteen years of age. In seven instances, multiple cases occurred in the same house. During the same time cases of pneumonia were very rare in Heidelberg. H. Schmidt observed thirteen cases of pneumonia from the 10th of May to the 19th of June in the village of Zang, a place of 549 inhabitants. Six of the cases occurred in one house.

CAUSES AND PREVENTION OF PNEUMONIA.

The conviction that pneumonia is an infectious disease has led to considerable investigation to discover the micro-organism which stands in a causative relation to it. In 1882 Friedländer discovered in the exudate into the pulmonary alveoli oval micro-organisms in pairs or short chains. Experiments on animals with pure cultures of this microbe, some giving negative and some what were accepted as positive results, lead Friedländer and a considerable following to regard this "pneumococcus" as the pathogenic agent in pneumonia.

Another micro-organism first named in 1880 by Sternberg* *Micrococcus Pasteuri*, and often now called the diplococcus of Fränkel, was discovered accidentally by Sternberg in his own

*Bacteria, p. 355.

saliva, and is now known to be often found in the mouth of healthy persons. Inoculated into rabbits it gives rise to "rabbit speticæmia." In 1885 A. Fränkel published the results of his studies upon the presence of this micro-organism in pneumonic exudate, and gave it as his opinion that it is more frequently present in pneumonia than the pneumococcus of Friedländer. The next year Weichselbaum reported the examination of the exudate in 129 cases of pneumonia. He found the microbe of Fränkel much more frequently than that of Friedländer. Wolf examined microscopically under Weichselbaum's direction the sputa of 70 cases of croupous pneumonia, and found the Fränkel pneumococcus in 66 of the cases and that of Friedländer only three times. Netter also investigated the sputum of pneumonic patients and found Frankel's pneumococcus in 75 per cent. of the cases during the disease and in 60 per cent. during convalescence.*

Gamaleia has done some important experimental work in inoculating animals with the microbe of Fränkel. In a recent paper on the "Etiology of Croupous Pneumonia"† Sternberg says:

Gamaleia has shown that "animals which are but little susceptible to the pneumonic virus offer a local resistance, which gives rise to very pronounced reactionary phenomena, and consequently they present, as a result of intra-pulmonary infection, a typical fibrinous pneumonia. Such animals are the dog and sheep." In his experiments upon these animals, Gamaleia obtained the following results: The sheep was found to survive subcutaneous inoculations, unless very large doses (5 cc.) of the most potent virus were administered, but intra-pulmonary inoculation was always followed by typical fibrinous pneumonia, which in the majority of cases proved fatal. The microbe was rarely found in the blood, and successive inoculations from one sheep to another were not successful. Death occurred after an intra-pulmonary inoculation on the third, fourth or fifth day. The pneumonia produced was lobar, and was attended with an extensive fibrinous exudation, in which the coccus was found in great abundance. In all, fifty sheep were experimented upon. I found in my experiments made in 1881 that the dog resists inoculations with this coccus. Gamaleia also obtained negative results when moderate doses were injected beneath the skin, but states that "intra-thoracic infection always causes a frank fibrinous pneumonia, which is rarely fatal; recovery usually occurs in from ten to fifteen days, after the animal has passed through all the stages of red and gray hepatisation which characterizes this affection in man." Twelve dogs were experimented upon. This micrococcus, then, which in very susceptible animals, (mouse, rabbit) invades the blood and quickly causes

*D. Med. Woch XIV., p. 658. †Lancet, March 2, 1889.

death by septicæmia, when injected through the thoracic walls in less susceptible animals (dog, sheep), or in an attenuated form in the rabbit, gives rise to the local lesions which characterize fibrinous pneumonia. Man comes in the category of slightly susceptible animals, as is shown by the comparatively small mortality from pneumonia, and by the fact that the micrococcus found in the exudate into the pulmonary alveoli does not invade the blood, unless in rare instances. We may, therefore, agree with Gamaleia in the following statement: "It is clear that the results obtained in the dog and the sheep, animals which have but a slight susceptibility, are most applicable to human pathology." In my paper read before the Pathological Society of Philadelphia in April, 1885, from which I have already quoted, I say: "It seems to me extremely probable that this micrococcus is concerned in the etiology of croupous pneumonia. * * * * But this cannot be considered as definitely established by the experiments which have thus far been made upon the lower animals." The experiments of Gamaleia go far towards settling this question in a definite manner, and considered in connection with those of Talamon and Salvioli, and the extended researches of Fränkel, Weichselbaum and Netter, leave but little doubt that this is the true infectious agent in acute lobar pneumonia.

It may here be said that some observers believe that the causative agent is not identical in all outbreaks of pneumonia. Finkler of Bonn, reported last year an outbreak of pneumonia affecting five persons, in the lungs of whom he found a streptococcus different from the microbe of Fränkel or of Friedländer. Klein of England, also, in investigating the epidemic of infectious pneumonia in Middlesbrough found a micro-organism which he claims is new, and which he thinks was the pathogenic agent in that outbreak.

Dr. H. B. Baker, Secretary of the State Board of Health of Michigan has, with considerable ingenuity elaborated a theory explanatory of the supposed action of low degrees of temperature in the causation of pneumonia, and in a paper read before the Ninth International Medical Congress he showed that, for his State, there is a pretty close correspondence of high pneumonia rate with low temperature. He refers to the fact that cold air is dry air; that while it may be relatively damp it is absolutely dry. His opinion is that, in cold weather, the continued abstraction of moisture from the mucous surfaces of the air passages and the lungs, leaves a residue of chloride of sodium and of other salts which, by their local irritation, give rise to bronchitis and pneumonia. By means of statistics, gathered in his own State and elsewhere, he shows that the greatest prevalence of pneumonia occurs in the colder months.

The mere fact of the correspondence of the maximum prevalence of pneumonia with the colder and more changeable season is no new idea, but has been a matter of common observation for a long while.

Some of the leading medical authorities believe that the influence of cold is causative of pneumonia only by closing up dwelling and sleeping apartments, thereby preventing so efficient ventilation as in milder weather, when doors and windows are open, and by driving people into their infected houses.

Many of the leading medical authorities now believe pneumonia to be an infectious disease. In some of the European hospitals outbreaks of pneumonia in the wards are followed by the same measures of disinfection as are applied to other infectious diseases.

The distinguished director of the laboratory of hygiene of the Faculty of Medicine of Paris, Dr. Netter, has recently published a remarkable paper on the contagion of pneumonia founded upon his own personal experience and the observations of others. He concludes that pneumonia is a transmissible disease. The contagion is due to a micro-organism, the pneumo-coccus which leaves the human body in various ways, but is especially abundant in the products of expectoration.

The contagion of the disease is possible for a long time after recovery from pneumonia, and this for two reasons: First, the contagion resists dessication, and thus it preserves its activity outside the human body on the surface of articles to which it adheres. Secondly, the pneumo coccus is found for a long time in the mouth of the patient after his complete recovery from pneumonia, and to this fact, perhaps, we may attribute the great frequency of relapses.

In laying down rules for the prevention of the spread of pneumonia, Dr. Netter does not believe that a rigorous isolation is necessary. The relatives of the patient should be prevented from passing the night in the same chamber and especially in the same bed with the sick. In hospitals the pneumonic patient should not be placed in a small room, especially when the room is to be occupied by others. The contagion has only a feeble power of diffusibility. Cases of infection are especially observed in small and badly ventilated rooms. Cases of pneumonia should not be placed in the same room with other patients affected with typhoid fever, measles, or other acute diseases of the air passages, nor with cases of nephritis or diabetes.

The sputum, if not the only medium, is at least the usual source of the infection, and should be disinfected.*

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*Revue D'Hygiene, X., 923.

CEREBRO-SPINAL MENINGITIS.

The general impression which has prevailed as to the infectiousness of cerebro-spinal meningitis was well stated by Stille* when he said:

No one of authority has claimed that this disease can be propagated by *contagion*. . . . That, nevertheless, there is a material morbific principle which inheres in certain localities, so that those who occupy them successively are likely to suffer from this disease, and that also this principle may be carried from place to place so as to render certain houses (barracks) infectious, seems to be demonstrated by the history of the disease in the French army.

This was written as recently as 1884, but since then, considerable work has been done in trying to discover the nature of this "material morbific principle," and though the identity of the real cause of the disease seems to be quite a ways from its final solution, recent tracks have been made in the field of discovery, possibly to be retraced. At the present time the following words from Fleischer† would receive the assent of many:

The infectious nature of the disease would hardly be doubted by anybody acquainted with its epidemic history, its importation into localities which had hitherto been free from it, its peculiar though irregular course, and its typical post-mortem appearances.

The most of the bacteriological work which has been done in connection with this disease indicates that the pathogenic agent is the same as in pneumonia. Some of the cases which have been the subjects of investigation have been uncomplicated, some have been complicated with pneumonia, and some have been cases of pneumonia followed by inflammation of the coverings of the brain and spinal cord (cerebro-spinal meningitis.) It is a fact of quite frequent observation that pneumonia is somewhat frequently complicated with inflammation of the serous membranes, for instance, the pleura, peri-and endo-cardium, and the meninges of the brain and spinal cord.

In the case of pneumonia complicated with meningitis, Eberth found a micro-organism in the exudations of the lungs, pleura, and meningeal cavities, which appeared to be identical with that which was described by Sternberg (see page 261.)

Foa and Bordoni-Uffreduzzi of Turin, reported in 1886, the finding of the same micro-organism in four cases of cerebro-spinal

*Pepper's System of Medicine, Vol. I. †Lehrbuch d. Inneren Med. 1888.

meningitis. Since then these investigators have had an opportunity to study an epidemic of this disease in their own city and their conclusions are that, while pneumonia may not always be caused by the same micro-organism, cerebro-spinal meningitis, on the contrary, is always caused by the same microbe, and that this is identical with that which Pasteur and Sternberg found in human saliva and Fränkel calls the diplococcus of pneumonia.*

The same microbe has been found in the meningeal exudations of cerebro-spinal meningitis by Fränkel, Weischelbaum, and others.

Recently Bozzolo† determined a doubtful case to be one of cerebro-spinal meningitis by an examination of the cultures derived from a drop of blood drawn from the liver with the exploring needle. The characteristic microbe was found. The case ending fatally, an autopsy confirmed fully the diagnosis. Wieschelbaum and Goldschmidt have both described a microbe in the meningeal fluid of this disease differing from that mentioned above, a diplococcus.

Dr. Friis‡, in a study of 180 cases of cerebro-spinal meningitis in Copenhagen observed thirteen "family epidemics." The period of incubation in the majority of cases, he thought, was from two to four days, though he says that direct contagion could not with certainty be determined.

EPIDEMIC JAUNDICE.

The following notes have been received from our medical correspondents in relation to this subject:

Dr. Mark T. Dodge, Troy.—During the year 1887 I had upwards of fifty cases of what I termed epidemic jaundice. The disease was more prevalent during the spring. It affected mostly children, and it was not uncommon to see all the children in a family sick with the disease at the same time, or with but a few days intervening between the dates of their attacks.

The disease was usually ushered in with symptoms resembling those of a severe cold, pain in the back and head, feverishness, nausea and vomiting. Within a day or two there would be marked yellowness of the conjunctiva and skin, with highly colored urine and generally clay-colored stools. The duration of the disease was from six to ten days, after which it would be a week or more before the patients could regain their full strength. There were no fatal cases.

*Zeitschrift fur Hygiene, 1888, p. 68.

†Centralblatt f. Bak. u. Par., May 31, 1889.

‡Uffelmann's Supplement for 1887.

Dr. Jason Walker, Minot.—On a certain hill in Poland there have been several cases of jaundice within a few months. The first case occurred last August in a girl twelve years of age. In this family five have had the disease, one at a time, the last case occurring the first of January. Their ages ranged from twelve to twenty-five years. In a neighboring family, which was intimate with the above-named one, two cases occurred in children fifteen years of age who were cousins and also second cousins to those in the first family. In another family of three children, a mile distant from the first-named, each had the disease.

One point seems worthy of note here: All the children in each of these three families suffered from jaundice, while none of the parents or other older members had the disease. Admitting contagiousness, I have been unable to make out any definite period of incubation.

The usual symptoms were irritability of the stomach, abdominal pains, urine scanty and very highly colored (in some cases mistaken for blood), fœces light colored, slight increase at first in temperature, becoming in a few days abnormal or subnormal, being in one case during convalescence 96° F. under the tongue, the pulse not much accelerated, and, in some of the cases, below 50°. The skin of the whole body, as well as the conjunctivæ, became yellow and remained so for many days. All the cases ended in recovery after an illness of two or three weeks.

Dr. W. A. Bumps, Dexter.—In the spring of 1886 I attended seventeen cases of jaundice. No fatal cases followed. I knew of many more cases in the adjoining towns.

Dr. W. A. Wright, Readfield.—We had an epidemic of jaundice in this town during the past year (1888).

Dr. F. W. Bridgham, Sullivan.—Among children ranging from five to eleven years of age I had twenty-six cases of jaundice, attended with much vomiting and tenderness over the liver. Every young child in the family would have it. The epidemic occurred in November.

Dr. C. W. Abbott, Albion.—I have delayed in answering your letter in regard to the contagiousness of jaundice in order to look the matter up a little. I am very positive in my opinion that it is so, and that the period of incubation is from ten to fourteen days. Nearly all of my cases could be traced from one preceding it in the family or from a neighbor. In some cases there was only a single exposure. In all the instances there was, I believe, only one family which escaped after one child had it. The rest of the children in this family, four in number, had it this spring. Four years ago jaundice prevailed in China, and they tell me that it worked the same there. One family of four had the disease, one at a time, two weeks intervening between the attacks.

Dr. L. O. Buzzell, Kittery Point.—The first case occurred in April and no other case occurred until October. There was no possible connection between the two cases. In the second family there were nine children, only one of whom had jaundice. Within

a week three cases occurred on the Creek road. There was no connection that I could discover.

During the next three months I treated over thirty cases, and there were nearly as many more cases which did not come under my observation. I do not recall any instance of more than two cases in any one family, and in most families only one case.

The symptoms of the different cases were about the same, irritability of the stomach, heaviness of the head, pulse slow, constipation, stools clay-colored, urine scanty and highly colored, conjunctiva a deep yellow, skin of varying degrees of yellowness, nervous system depressed, temperature normal or subnormal, anorexia, thirst. The duration was from eight to eighteen days, the age from one to eighteen years; both sexes were attacked in about equal proportions. No fatal cases; no sequelæ. The conclusions I draw are:

There is such a disease as epidemic jaundice.

It is not contagious, or at least mildly so.

It is a disease more serious in appearance than in reality.

The cause is not easily discoverable and to the writer wholly unknown.

Dr. C. P. Hubbard, Lowell.—There were quite a number of cases of jaundice in town this fall (1888). All the cases occurred within a period of about three weeks. A number of the people said their children caught the disease by going to a neighbor's house where the children had had it.

ON THE DE NOVO ORIGIN OF INFECTIOUS DISEASES.

In addition to the remarks of Dr. W. W. Thomas of Yarmouthville, on page 238 in regard to the spontaneous origin of diphtheria, he has communicated the following interesting facts and opinions in relation to the *de novo* origin of infectious diseases in general:

A commercial traveller, or runner for some firm came to this town in the spring of 1886 with what he supposed to be a bad cold. He was around in the stores here for a day or two, finally becoming so sick that he had to go home. Nobody heard from him for some time afterward, but in about ten days several of the clerks and salesmen began to complain of a very bad cold. Thinking that it was only a cold they did not see a physician and some of them stood behind their counters dealing out goods until the eruption of measles appeared. The result was 150 cases of measles in this vicinity, but fortunately not one proved fatal, though in many cases the disease was very severe. It was afterward ascertained that the runner had measles on his return home.

During the season of travel, in July or August, a person who has *typhoidette*, or what has usually been called the walking form of typhoid fever, comes into a place where there are no cases of this disease and where perhaps there have been none for years. He

thinks that he is not sick enough to consult a physician, and keeps about. but has some diarrhœa, headache, etc. He makes his visit and disappears. Now, if, in from two to three weeks, one or more cases of typhoid fever appear everybody is wondering where it comes from. Some will say "he has been hard at work and has become run down and brought on the fever," and others will say "it came in the air; anybody is liable to have it." The doctor is called in, he looks solemn, walks around the house, takes a look at the sink-spout, measures with his eye the distance between the well and the pig pen, but does not find much at fault with these appointments. He descends to the cellar. He finds this wet, some rotten boards, and a bushel or so of decaying potatoes, and he announces the discovery of the origin of the cases of typhoid fever up stairs, and perhaps he summons the neighbors to clear out the cellar, while the nurse up stairs is pouring the undisinfected discharges from the patient, down the privy-vault.

Now this is not an over wrought case, it has happened again and again. Forgetting that typhoid fever is a specific disease, and that it must have a specific cause, and that, therefore, it can never originate *de novo*, physicians have sometimes been too willing to blame some sink spout, cess-pool, or pig-pen that was bad enough, perhaps, as a cause of general ill health, but was lacking in the typhoid germs, and was, therefore, perfectly innocent of starting a typhoid outbreak.

When I see a spear of corn growing, I know that in some way a kernel of corn has become planted in that spot. If its growth is strong and the color of its leaves a dark green, I think it has found fertility in the soil, but this richness did not originate the corn. So when I see a case of typhoid fever in a place where there have been no cases for years before, I want to know where the patient has been for the last month, or who has been in his neighborhood within the same time; for however filthy his surroundings might be, I should never for a moment believe that the specific germ of typhoid fever originated in that filth any more than I should believe that the poison of scarlet fever or small-pox could originate there.

IS TYPHOID FEVER GENERATED SPONTANEOUSLY?

From Dr. J. S. Sturtevant, Dixfield.—It fell to my lot to attend a case of typhoid fever which I decided to be of spontaneous origin. The case was in the village (Dixfield) and it is the only one that has been in this place since I located here (Oct., 1885). The young man, about twenty-one years of age, had been "ailing" some time. About the 16th of September, 1887, he went to a neighboring town and did a job of work and got to perspiring quite freely, then rode about three miles and became very chilly. When he arrived home he was quite feverish and his parents thought he was suffering from a bad "cold." He took his bed the 19th of September. I was not called until the 24th and found him with a well marked fever. The disease reached its height Sept. 29th-30th,

then a gradual decline, when convalescence was established about Oct. 22d. I made a thorough inspection of the premises and found everything neat and clean. Water from a driven well. I notified the local board of health. There was one boy, about ten years old, at home all of the time, and one twelve years old, a part of the time.

If we take into consideration that there was no doubt whatever that this was a typical case of typhoid fever, as we got all the characteristic symptoms,—headache, backache, epistaxis, delirium, rose-spots, stools, etc.,—and that none of the family, or people in the town, have had any signs of typhoid fever before or since, and as the patient had not been away from home to obtain the disease, it seems to me to be a very clear case of spontaneous origin.

Dr. L. L. Hale, Chebeague Island.—A case of typhoid fever came under my observation (1887) which was undoubtedly of spontaneous origin, as there had been no cases of typhoid fever on this island for many years. The patient was a young man twenty-seven years of age, and during the summer and fall had been engaged as clerk in a grocery store until within about six weeks previous to becoming ill. This store was situated upon a wharf built of earth and stone, and just outside the building were piled up some fifty barrels of putrid and decayed clam bait. A window in the western side of the store, which was open in warm weather, was in close proximity to the putrid mass. After the patient had ceased working in the store, which was one month and a half previous to his becoming ill, he spent more or less of his time there each day. There is one other factor in relation to the causative agent in this case which I will communicate. Fourteen and fifteen days previous to patient's commencing illness he had been engaged in the digging and sorting of rotten potatoes at his home.

From Dr. Jason Walker, Minot.—I treated a case of typhoid fever last summer (1888) in Poland, which, so far as I could learn, seemed to be of spontaneous origin. No other case in that vicinity during the season. The sanitary conditions of the place seemed good (exceptionally so for a farm-house.) There had been no typhoid in the house for many years, if ever. The water supply came through a pipe from an excellent spring of pure water many rods from the buildings. The cellar under the house seemed to be clean and well ventilated. The waste water from the sink was drained to a long distance from the house. The case seemed to be quite a typical one and proved fatal at about the end of the third week.

In most histories of this kind we cannot exclude the possibility of infection either at home or during temporary absence from home. To do this we must have a voucher that every glass of water, milk or other drink, and the ice which is used in it is free from the disease germ; we must have a full knowledge of the actual and recent pathological conditions of those who come and go at the

places which are visited abroad, as well as at home. As places infected with the typhoid germ may retain this infection a long while (so it is generally supposed), the clean bill of health must apply to a considerable period of past time, as well as to the current weeks. In some of the newer portions of this state, this may be done with more of a show of probability than in older and more thickly settled places.

Nevertheless many of the most trustworthy leaders of medical thought express their entire disbelief in the strictly spontaneous, or *de novo* genesis of cases of typhoid fever, and the following expressions of opinion may be taken as representative of this class of authors:

Dr. R. Bruce Low,* lately one of the leading English Medical Officers of Health and now Medical Inspector for the Local Government Board, referring to typhoid fever says:

The *de novo* theory has of late lost ground. There are few men of any eminence who now accept this theory. Its great recommendation is that it saves the investigator any further trouble. It is enough to find some insanitary condition, and stop there. There are not yet many who believe that a specific poison like that of typhoid can be produced by a process of evolution from the culti-vation of previously harmless putrefactive bacilli. Of late my conviction has been growing stronger that isolated cases which appear without any obvious connection with a previous one are in reality due to the accidental disturbance of the leaven of uncleanness (the fever poison), contained, for example, in some disused or blocked-up drain, into which, many years before, the specific discharges had been introduced.

Dr. W. H. Broadbent† says:—There is overwhelming evidence that as a rule the poison is derived from some previous case, and the only facts which seem to require the supposition of its independent origin are occasional outbreaks of fever in villages or isolated buildings which cannot be traced to any known source. On similar grounds, however, we should have to admit the origin *de novo* of small-pox and all other contagious affections, and it should be added that with increasing experience in investigations of this kind unexplained outbreaks become more and more rare.

The opinion of Fleischer‡ is as follows:—At the present time we know that the infection of typhoid fever never originates of itself (generatio æquivoca) even in places or ground especially favorable for its multiplication. The ground contains typhoid fever germs only when it has received them from typhoid fever patients.

Liebermeister§ says:—All observations agree in proving that the disease (typhoid fever) never occurs spontaneously, and that in

*Sanitary Record VII, 366. 1886.

†Quain's Dictionary of Medicine, 1884.

‡Lehrbuch der Inneren Medizin, 1888.

§The Infectious Diseases.

order for it to undergo development in a given locality, it is essential that the germ shall exist there already, or be in some way introduced there.

The following cases are interesting and suggestive in this connection as bearing upon the question of the persistent vitality of the infection under conditions which are favorable to it.

In the village of Riedheim in 1864, a young woman returned to her home from Ulm sick with typhoid fever. During her illness her dejections were thrown upon a heap of manure and after a period of five weeks this manure heap was carted away. All the persons who were employed in this work of removal became sick with typhoid fever.

The discharges from these last patients were in the same way thrown upon a heap of manure which remained for nine months. The persons who were then employed in transporting it to the field came down with typhoid fever, excepting those who had already had the disease.

Dr. R. Bruce Low* reports the following history:

In July last a typhoid case was reported in my district. Nearly four years had passed since the last case. The sufferer was the wife of a small shopkeeper. The house was superior to many of its class. It had no water-closet, there was a privy in the back yard, at a safe distance from the house—dry, clean, and well kept. There was a drain in the yard for slops, running into a stream close at hand. No dung-heap nor any filthy accumulation was near the house. The water supply was common to a number of houses, in none of which, before or since, was there any case of fever. The milk supply, too, was common to a number of other persons, none of whom suffered. None of the family had been out of the district for some months, and all persons who had visited at the house could be named and followed up without affording a clue. All the usual lines of investigation were carefully followed without result. It transpired, however, that the shopkeeper had rented another small house, nearly opposite his own and had used it for storing goods. The back yard of this second house was wet, and the surface water did not get off freely. There was a gully at the back door communicating with a drain, which was evidently blocked when he first took possession of the house three years ago. One hot day in June, assisted by a friend, he opened the surface of the yard, and found a square brick drain, about 12 inches by 8, choked for a distance of four yards with black, foul-smelling slime. The soil round this drain was saturated with this filthy mud. The men cleared the drain and carried off the contents to some cultivated land. While these operations were being carried on, and at the time when the stench was at its worst, the shopkeeper's wife came over to speak to her husband. The smell sickened her, and she returned home. Fourteen days afterwards enteric fever was fully developed. She

*Sanitary Record, vii, 368.

complained of being out of sorts from the time she was exposed to the smell.

Here, then, is a foul accumulation discovered, but the specific poison has not yet been traced into the choked drain. There is a popular notion that a bad smell can cause fever, but this, of course, is erroneous. The smell itself cannot cause fever, unless it contain the specific poison. On referring to my journal, I found that ten years ago there had been a case of enteric fever in this house which had the blocked-up drain. This case was imported, and was duly investigated at the time. This defective drain was then, as now, the only channel for the removal of slop-water, unless it was carried by hand a distance of thirty or forty yards and thrown into a running stream. This drain had always been a source of trouble to the tenants. It was made of brick, and had not a proper fall; it was easily silted up. As this drain was the only means for removing slops, it is certain that at least in the earlier stages of the fever, the urine, and perhaps the water in which the soiled linen, etc., had been washed, would be poured down the drain. It is not difficult to believe also that, in spite of warnings to the contrary, some of the diarrhœal discharges would be poured down the grate, to save the trouble of carrying them away into the garden. In this manner, then, the blocked-up drain received its specific contamination ten years ago. If this fact be true, and I have no doubt whatever that it is so, we have here evidence that the poison of enteric fever can retain its vitality under suitable conditions for ten years. And if for ten, why not for twenty or fifty years? The accidental liberation of the fever-germs on a hot June day, by the opening up of the choked drain and the inhalation of this poison by the woman, was followed in due course by the development of the true typhoid fever. If the poison of typhoid fever has the power of lying dormant for years in a suitable soil, and leaping into life whenever an opportunity of escape offers, we have, I maintain, a probable explanation of the origin of many mysterious outbreaks, formerly referred to the *de novo* theory.

DOES ONE ATTACK OF TYPHOID FEVER CONFER FUTURE IMMUNITY?

From Dr. Wm. A. Banks, Rockland.—In reply to the immunity question of typhoid fever in my experience, one attack offers certain protection against future attacks. No individual under my observation has had a second attack. My father contracted the disease at the age of 21, lived to the age of 86 without again contracting the disease after many exposures. I contracted the disease at Barnwell, S. C., at the age of 23. I have treated several thousand cases since in military and private practice, having as many as three hundred patients of that disease at the same time in the same hospital (Fall's Church, Va.) without having a second attack.

From Dr. G. A. Wheeler, Castine.—As to immunity I would say that I had typhoid fever at the age of twelve and again at the age of twenty-five. Both cases were diagnosticated by experienced physicians. The first illness was of some nine weeks duration and the second twelve weeks.

From Dr. A. K. P. Meserve, Mem. Bd. of Health, Portland.—I never saw but one instance in which a person had a second attack, and in that I depended upon the diagnosis of another person, for the first attack.

From Dr. J. A. Richards, Farmington.—In regard to the question of immunity of typhoid fever I think it is as a rule protective, but when one has it the second time it is usually fatal. I call to mind now only two cases of the kind.

From Dr. W. W. Thomas, Yarmouthville.—I have never seen genuine typhoid fever twice in the same person and think it must be rare. I believe this to be a very strong argument in favor of the specific nature of the disease, and therefore that it is never spontaneous.

Dr. Chas. E. Banks, Surg. U. S. M. H., Portland.—But one case occurring in my practice during the past year (terminating fatally) had any claim to be thought to be a second attack. The patient was a sailor, and his father, the captain of the vessel, informed me that this was the second time he had been ill with the disease, the previous instance being about twelve months before. The father was an intelligent man and a close examination as to symptoms, duration, etc., seemed to make it a probable case of recurrence of the disease in the same person.

From Dr. F. A. C. Emerson, Garland.—As regards immunity, all my cases (1887) were first cases, and all whom I positively knew to be exposed to infection without contracting the disease had had it before.

From Dr. Orin Stevens, Oxford.—I never had two cases of typhoid fever in the same person.

From Dr. S. Burbank, Secretary Local Board of Health, Mt. Vernon.—In a practice of twenty-three years I remember but one instance in which a person had typhoid fever a second time with well marked symptoms.

From Dr. S. M. Bradbury, Limington. I think one attack of a clear case of typhoid fever offers protection against future attacks as a case of small-pox does. In 1839 I had many cases of typhoid fever. They all recovered. They have all but two died since then, but not one of these cases ever had any symptoms of typhoid fever since the first attack, and I never knew of a second attack in the same individual.

From Dr. Henry Reynolds, Livermore.—One of my cases of typhoid fever had, several years before when a child, a previous and severe attack of the same disease. The second attack was of moderate severity.

From Henry B. Palmer, Phillips.—In the winter of 1884 I attended a patient with typhoid fever of four weeks duration. The

present winter I have attended the same person through another attack of three weeks duration. The last attack was an unusually severe one. I think one attack offers no protection whatever against a second.

From Dr. F. C. Perkins, China.—I have never seen a second attack in the same individual.

HOW IS TYPHOID FEVER USUALLY SPREAD?

Dr. Budd of England, long ago strongly insisted that the discharges from the bowels in cases of typhoid fever contain the infective agent of the disease. This opinion is now generally regarded as true. American and English physicians have also accepted it as definitely settled that the most frequent way for the infection to reach its victims is through the water which is used for drinking purposes, but upon the continent of Europe, the medical profession has been divided between the "water theory" and the "ground theory." Koch of Berlin, is the acknowledged leader of the party which contends that the usual medium of communication of the infection is the drinking water supplies; Pettenkofer is none the less the able chief of that faction which claims that the *modus operandi* of the infective matter is to pass into the soil, there undergo a process of development, and, rising through the soil, to infect through the medium of the atmosphere. The discussion between these two parties still goes on, sometimes not free from bias and acrimony, but within the last few years those who claim the water origin of typhoid fever have been gaining accessions rapidly, and some of the recent converts had been the former able advocates of Pettenkofer's theory.

With one who impartially examines the evidence there should now be no hesitation in concluding that drinking water which has become infected with typhoid fever excreta is capable of communicating the same disease, and that this is a very frequent way of transmitting it. This does not, however, exclude other methods of infection which will be mentioned in the following pages.

IMPURE WATER AND TYPHOID FEVER.

The following abstracts of the histories of typhoid fever outbreaks, taken from various recent sources, are thought to be of sufficient interest to be recorded in this connection. They illustrate

nicely some of the various ways in which the typhoid infection is transmitted by water, and some of them promise to remain historic.

Typhoid Fever at the Garrison of Angouleme.—The following facts were reported by Dr. Richard in the *Revue D'Hygiene*, X, 823:

The etiological studies of Dr. Roux on the prevalence of typhoid fever in the Garrison of Angouleme have shown that between 1887 and 1888 there had been 1,779 entries at the hospital and 301 deaths from this disease. In the first half of the year 1887 there were 332 cases and 30 deaths among 3,290 men, and this on elevated ground, in new barracks outside of the city. The unquestionable cause had been the water supply which was taken from two streams, the Charente and the Touvre. Two of the principal sewers of the city emptied into the Charente above the intake of the water supply; one of these sewers received the contents of 20 privy vaults. The Touvre received, four kilometres (about two and one-half miles) higher up, all the dejections of the city of Ruelle, with a population of 3,000. The great schools of education, the Lyceum, and The Sacred Heart, remained entirely free from the disease during all the epidemic of 1887, notwithstanding their situation in the center of the city. For this last six months they drank no water until it had been boiled and filtered. But several of the *externes* who took their meals at home took the disease.

In the height of the epidemic, May 10, the 21st regiment of Artillery broke camp and pitched their tents on the exercise ground distant from the barracks, but where they continued to drink the city water. With them, the epidemic pursued its course and occasioned 40 cases during the month of May. The larger part of the regiment then removed to Braconne, where they had water of excellent quality. During the first few days at Braconne, four more cases of typhoid appeared, and then not one more, while, among the 200 who remained in camp on the exercise ground, there were 15 additional cases.

The 34th Regiment of Artillery, severely affected, left for Braconne on the 25th of April, and had no more cases, while among the small detachment remaining in their quarters, there were 17 more cases.

When the school of practice met it camped in two portions; one, which used the city water, had eleven cases of typhoid fever, while the other, which was supplied with very pure water, remained entirely free from the disease.

This experience led to the supplying of the garrison with water from a different source than that of the city, and since then the military population has been entirely exempt from typhoid fever.

Outbreak of Typhoid Fever at Nowawes:—At one of the meetings of the German Public Health Society in Berlin, in 1887, Dr. Falk* gave the history of an outbreak of typhoid fever which

*Verhand. der D. Gesellschaft f. offent. Gesundh. 1887.

happened in the village of Nowawes near Potsdam, a place of about 7000 inhabitants.

This outbreak came suddenly, and there were due to it seventeen cases, in thirteen households and upon eleven house lots. It was confined to the principal street running north and south, and to a particular part of this street. The water supply of this street was derived from three wells and the typhoid fever cases were restricted to just those houses whose water supply came from the middle well. There appeared to be no origin for the infection other than through the water supply. The year previous there had been a case of typhoid fever in a neighboring house and it was thought that the dejections from this case might have reached the well, but Dr. Falk could not understand why the development of the germs were delayed so long. A qualitative analysis was made by Dr. Paul Guttmann, but he failed to find the bacillus of typhoid fever.

In this case the evidence seemed to be strong enough to make it probable that the well was guilty of causing the outbreak, yet the bacillus was not found. This is what has happened quite frequently in similar outbreaks, and may have been due to several causes: 1st. It is difficult to discover the bacilli when they are present. 2nd. They may have been present earlier and have disappeared. 3rd. In the discussion, Dr. Guttmann, referring to the experimental work of Shotinin, (given on another page of this report) suggested the possibility of a water's containing the poison (ptomaine) which causes typhoid fever without containing at the same time the micro-organism which produces the poison.

*Typhoid Fever at Cluny.**—In the summer of 1887 an epidemic of typhoid fever raged in the Normal school in the French city of Cluny.

In a school population of only 235, 119 persons fell sick with typhoid fever and 12 died. Of the *personnel* of the school, therefore, more than one-half took the disease. The epidemic remained exclusively concentrated in the school. In the city outside the school, there were not more than two or three cases of the same nature, excepting among the day pupils who boarded at home but received their infection at the school.

The first case of typhoid fever at the school occurred June 15. This pupil was removed to the infirmary. The drain from the infirmary, into which the discharges from this first case were poured, ran into the sewer at a point only 10 or 12 feet from the well which supplied the drinking water. In three weeks from the removal of the first case to the infirmary the epidemic began. Chemical analysis showed the water from this well to be rich in organic matter and a bacteriological examination revealed the bacillus of typhoid fever in it.

Typhoid Fever in the College of Quimper.†—In February and March, 1888, a somewhat similar outbreak occurred in another

*Annales D'Hygiene Publique, XX, 429. †Revue D' Hygiene X, 457.

French town in the Lyceum, or college of Quimper. The whole *personnel* of the school was 381. Of these 155 were *externes*, pupils boarding outside and drinking but little or none of the water at the school. None of these had the fever. Among the remaining 226 persons there were 34 cases of typhoid fever. At the time of this school epidemic there was only a single case of typhoid fever in the city outside of the school, and this in the person of a woman who used no wine after the style of the country, but drank water from the college supply. The water supply of the school was entirely distinct from that of the city, and was derived from a shallow well and a cistern, both so situated that they were exposed to the danger of pollution from the privies of the institution, from the method of disposing of excreta in an adjoining prison, from the privies and human and animal filth of the adjacent market, or fair ground, all of which were on higher ground and delivered its drainage and subsoil soakage in the direction of the shallow well. The well water and the cistern water were mingled before delivery for use Furthermore, the cistern far from being tight, was situated close to the street, opposite to the point where a drain received the sewage which flowed in the gutter from the more elevated part of the city.

Samples of the water supply examined by Dr. Roux, sub-director of Pasteur's laboratory, were found to contain the bacillus of typhoid fever.

*Typhoid Fever at Pierrefonds.**—Twenty-four persons came from Paris and Versailles to spend the months of August and September, 1886, in three houses, C., R., and B., at Pierrefonds. Twenty of these persons took typhoid fever, or had symptoms referable to the action of the typhoid infection. Four died, six others were severely sick. The remaining ten had the disease in a lighter form.

This was not the first time this disease had struck these houses; from the proprietor it was learned that typhoid fever had been in one of these houses five times between 1874 and 1883. These houses were built upon a sandy soil which rested upon an impermeable layer of clay, and the ground-water usually stood not more than four or five feet below the surface. From this source the water supply was obtained by digging shallow wells. These wells all communicated though the sandy soil with one another. A few years before, a man on the other side of the street let a can of oil fall into his well, and in three or four days the oil appeared in the well belonging to the house C. In the same way it was thought that the leaky privy vault, communicated just as freely with the wells. The bottoms of the privy vaults were a little higher than the surface of the water in the wells.

* Revue D'Hygiene, IX, 116.

In the house C., five persons among seven took the disease.

In house B., seven persons out of nine took the fever.

In house R., the whole family, consisting of eight persons, had the fever.

Samples of water from the well at house R. were sent to Chantemesse and Widal in Paris and the Eberth bacillus of typhoid fever was found. A sample taken Oct. 13 contained about 25,000 bacilli per litre; another sample taken Oct. 29, contained many less, and a third taken Nov. 2, had none at all.

The bacillus was also found Oct. 29 in the water of a brook below the well, and into which the water from the well percolated. In reaching the brook the bacillus was supposed to have passed through the sand a distance of at least 130 feet, though the condition of one of the vaults and its drain appears not to have precluded the possibility of the transportation of the bacillus from the vault to both the brook and the well by direct surface wash during the heavy showers.

The bacillus was not found in the wells at house C. and house B. Chemical analysis showed the water at house R. to be the least contaminated of the three.

We have seen that four persons in these three families did not take the fever. The family in house C. moved in August 1st, but the father and his mother-in-law did not come until August 25th, and perceiving that the water was not good, did not use it. These two persons escaped.

In house B. the father did not come until September 6th, and remained but a single day. He and the cook, a woman thirty-five years old, escaped. She stayed only one month and it is not known whether she had previously had typhoid fever or not.

Of the three persons who drank the water only once or for but a single day, can we believe that the water did not contain the bacillus on August 25th and September 6th, or is the disease produced only after the ingestion of a certain number of germs, or had these three persons previously suffered the typhoid infection, unknown to themselves, but still capable of conferring immunity?

In the family in house R. all of the eight persons became sick between the 25th and 28th of September. *Four of these had previously had the disease.* Of these four, none died. The father, fifty-seven years of age, had had a severe attack of typhoid fever when eighteen years old; the second attack was mild. The mother, fifty-one years of age had had an extremely severe typhoid fever at the age of eighteen years; the recent attack was mild. One of the daughters, Marguerite, twenty-six years old, had had a severe attack three years before; for the new attack she had only for some days an evening accession of fever. The chambermaid had had typhoid fever five years before; the new attack was not severe.

We may mention as showing the intensity of the disease and the probably large dose of the infection which had been taken, that of the four persons who died in this family, two died on the eleventh day, one on the thirteenth day, and one on the sixteenth day.

*Typhoid Fever at Clermont-Ferrand.**—An epidemic of typhoid fever raged in Clermont-Ferrand, during September, October, November and December, 1886, and Drs. Brouardel and Chantemesse were sent to make an investigation as to the causes.

Two hundred and fifty-three cases had occurred. Suspicion centered upon the public water supply and numerous facts like the following strengthened the suspicion:

In the infected quarter Dr. P. lived with his family, in which were two boys, fourteen and fifteen years of age, a man servant of twenty, and a maid of nineteen. The Doctor's family drank mineral water and remained well. The two servants drank from the water supply and both took the fever. The younger of the two boys also had a *typhoidette*; he acknowledged that he had drank the water from the kitchen tap though he had been forbidden to do so.

Dr. C. lived in a house which was the only one spared from fever in all that quarter of the city. The house contained many persons, of whom several had lately arrived from the country. They all, after the beginning of the outbreak, drank water only which had been boiled.

The convent of Ursulines, containing many persons, used the water from a particular fountain in its park. All its *personnel* escaped the fever save one. This one had gone on the 11th of November to see her parent, and then had drank from the Clermont water supply. Ten days later she had come down with the fever.

During their investigation, which lasted six days, no instance could be learned in which the fever had developed in persons using exclusively mineral water, or water which had been boiled.

The investigation showed that defects in the system of taking and distributing water, permitted a danger of pollution with the water from a laundry in which the clothes of a typhoid patient had been washed, and from the discharges of patients who had imported the disease from other places.

Samples of water were taken for the bacteriological examination and in one of them the bacillus of typhoid fever was found.

The following interesting history of how typhoid fever was spread in Pottsdam, Ohio, through the medium of water carelessly polluted and infected, is taken from the Third Annual Report of the State Board of Health of Ohio:

In the fall of 1883, a gentleman living in Indiana contracted typhoid fever. When well enough to travel his wife brought him to her father's house (her father at that time lived in this locality), and while there she also contracted the disease, which ran a very typical course. No isolation or disinfection was practised, her stools being emptied into a privy within seventy-five feet of the well. Her clothes were washed in a building with a loose floor, immediately over the well. In a short time her father's family contracted the disease, four members of which died.

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*Revue D'Hygiene IX, 368.

The above history I obtained from the attending physician when I was called in consultation. Since then I have had personal observation of the following cases directly connected with the above named cases. One of the sons of the afflicted family, after recovery, went to live with a neighbor. In a short time this family also contracted the disease, the father dying. The same conditions existed as to disinfection as in the previous family. While this family was sick, two brothers-in-law visited them, assisting in caring for their wants, drinking water from the already infected well. Both of these men, with their families, contracted the disease, one of the men dying. In one of the families disinfection and cleanliness were rigorously carried out, with the result that no case has yet arisen from that place. In the other family disinfection was not carried out, notwithstanding my directions, and ere the family had recovered a sister. who had often been in attendance, contracted the disease and died, and two of her children also contracted the disease, but recovered. A neighbor girl was employed a year after in the family in which disinfection was neglected. Soon she contracted the disease, returned home and died. The mother, a sister and two brothers also contracted the disease, and two more died. Of these last cases I wrote you some time ago, how, in spite of warning, the vessel containing the discharges of the patients was emptied upon the ground not far from the well. What cases will follow this gross neglect remains to be seen.

Here is the history of twenty-three cases of typhoid fever with ten deaths, all due to an infected water supply, from carelessness in the disposal of the discharges of the patients.

In answer to an enquiry as to the manner in which the disease was carried "by one of the sons of the afflicted family *after recovery*," Dr. Deahofe writes as follows:

"I have just interrogated one of the family first afflicted. He informs me that this son of whom I spoke had not recovered entirely, but went to live with his neighbor, when he should have been in bed (he was still suffering with diarrhœa); that a daughter of this same family did not take to her bed until about the third week of her illness, but afterwards died, showing the apparent mildness of the disease."

TYPHOID INFECTION THROUGH THE AIR.

In this country it is generally believed that the typhoid infection is communicated through the medium of drinking water far more frequently than in any other way, yet there are eminent authorities who believe otherwise.

Liebermeister* thinks that infection by the air seems to be the ordinary mode of conveyance.

*The Infectious Diseases.

Dr. F. Seitz * believes that the most frequent medium of communication of the typhoid fever infection is the air.

In the early part of the year 1888 the State Board of Health of Michigan was called upon to make an investigation in regard to the causes of the prevalence of typhoid fever in the State Prison at Jackson. It was found that the soil pipe which came down from the hospital, and into which discharges from typhoid fever patients were thrown, had a leak, and that the currents of air in the building were drawn from this leaky soil pipe and also from an imperfectly trapped slop-hopper into the west wing, in which the prevalence of typhoid fever had been far more marked. It was suspected that the leakage of sewer-air containing typhoid fever germs had been the cause of the prevalence of the disease, and Dr. Vaughan, Director of the State Laboratory of Hygiene collected samples of air from the suspected sewer. By means of cultures this air was shown to contain the bacillus of typhoid fever, giving thus what we may consider a positive demonstration that sewer air may be the bearer of typhoid fever germs.

TYPHOID INFECTION BY SOILED CLOTHING.

The somewhat frequent occurrence of typhoid fever among washerwomen after having washed the clothing of typhoid fever patients is often, and with apparent right adduced as proof that the infection of typhoid fever may be carried and transmitted in clothing which has been soiled by the discharges from the typhoid patients. The following also illustrates how clothing may be the means of communicating typhoid fever:

The history of an epidemic lasting from 1873 to 1885 in a German artillery barracks, causing 146 cases, recently reported in the *Medical Press*, illustrates the danger of infected clothing. During this long period all possible sources of the disease were subjected to careful scrutiny without result, until suspicion fell upon the bed and body clothing. It was then ascertained that three of the recent cases had used the bedding and clothing of men that had been attacked. This led to a closer examination, when it was discovered that the lining of the trousers were soiled with dried fecal matter. Although this clothing had been exposed to sulphur vapors the poison had evidently not been destroyed. Thorough disinfection with first, thorough cleansing, then 12 hours saturation with chlorine gas, and afterward dry heat for several hours put a stop to the epidemic.†

* Der Abdominaltyphus; 1888.

† Annals of Hygiene, III, 216.

TYPHOID CARRIED BY THE HAND OF THE NURSE.

A recent issue of one of our leading medical journals says:*

"Infection by means of the clinical thermometer in hospital wards, and through nurses who attend typhoid fever patients at one moment and presently prepare ice water without previous disinfection of the hands, is a sure thing, in my opinion, and the possibility of its occurrence should be borne in mind and avoided by all means."

An outbreak of typhoid fever was investigated by the secretary in 1886, in which infection through the medium of the water and milk supply and the other more usual sources could reasonably be excluded. In this "house epidemic" the disease assumed a very malignant form, and it seemed very probable that the infection was distributed by the hand of the mother, who was the attendant upon the cases. The members of the family were very careless and filthy in their habits, and the attending physician said that he had seen the mother, interrupted in the process of bathing one of the children, immediately stir meal into a dish of gruel, without stopping to wash her hands. The first case, a little boy of ten years, was attacked with a mild form of typhoid fever, August 13th, and recovered. The second, third and fourth cases were attacked respectively September, 18th, 23d and 25th, and died respectively September 30th, October —, and September 28th. The father had a mild form of the disease, and the mother was sick afterward.

Ollivier of Paris has reported two cases of typhoid fever which he thinks were instances of direct communication of this disease in a hospital, and Dr. Wasserfuhr † mentions the communication of typhoid fever in the hospital at Hagenau in 1882 to a child which had not left its bed for a long time, and had not used the water closet which was common to the ward. This is also given as a case of direct infection, but we are not told in regard to the possibilities of infection from the water supply or from soiled clothing, or the hands of the attendants. Cases of direct communication of typhoid fever are not very often reported and should probably be referred to one of the four ways of communication which have been illustrated.

THE SPECIFIC CAUSE OF TYPHOID FEVER.

In 1880 Eberth found, in the spleen, swollen lymphatic glands and in the pathologically changed parts of the intestinal tract of

*New York Med. Journal, Jan. 19, 1889. † Uffelmann's Sup., 1883.

patients who had died of typhoid fever, a bacillus which he was led to believe to be the specific germ of this disease. In 23 cases he found this micro-organism 12 times. He found the bacillus the more frequently the earlier in the course of the disease the patients died.

This micro-organism is described as a motile bacillus three times as long as broad with rounded ends. Sometimes it forms long threads. With the aniline colors it does not take so intensive a stain as most other similar organisms. Its growth is slow. When sporulation occurs the spores are contained in the ends of the rods.*

Independently of Eberth, Koch had studied this same bacillus and had found it in one-half of the cases examined, and had put his work on record in the form of a series of photographs of the micro-organism before Eberth's first work appeared.

Meyer also in 1881 reported the finding of this bacillus in 16 out of 20 cases.

In 28 cases of typhoid fever investigated by Gaffky† he failed to find the bacillus in only two. In one of these it would seem to the reader that he might have claimed the presence of the bacillus; in the other the patient had died of a secondary affection after the typhoid affection had run its course. In the bodies of patients who have died of other diseases the bacillus is not found. The growth of the bacillus upon nutrient gelatine and potato is characteristic and serves to distinguish it from the putrefaction bacteria.

Dr. Lucatello‡ of Genoa draws attention to the diagnostic importance of the presence of the typhoid bacillus in the blood of the spleen. He takes it with antiseptic precautions with the needle of the hypodermic syringe and he finds the specific micro-organism in almost all his cases.

C. Seitz examined the dejections of typhoid fever patients 19 times and found the bacillus 8 times, and a few times in the urine. Neuhaus found the bacillus in the blood from the "rose spots" 9 times in 15 cases. Meisel found it in the blood from the finger 19 times in 20.§

Pfeiffer discovered the bacillus in the intestinal contents of typhoid fever corpses and in the discharges from the living patients. Fränkel and Simmonds and Seitz have also identified the bacillus in the typhoid dejections.§§

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*Eisenberg, Bakteriologische Diagnostic, 1886.

†Mittheilungen aus dem Kaiserlichen Gesundheitsamte, 1884.

‡ Giornale d. Reale Societa Ital. D'Igiene IX, 392.

§Uffelmann's Supplement for 1886.

§§Seitz Der Abdominaltyphus, p. 161.

THE BACILLUS OF TYPHOID FEVER FOUND IN DRINKING WATER.

The following comprehensive *resume* of the instances in which the bacillus of typhoid fever has been found in drinking water, is from the pen of Dr. Charles V. Chapin,* Superintendent of Public Health, Providence, R. I. It gives also an interesting account of the finding of the bacillus of Eberth in the public water supplies of that city.

In epidemics of greater or lesser magnitude, traceable to drinking waters, the water has in a number of instances been examined for the bacilli. That they have not always been found need not surprise one who is at all familiar with the difficult processes of bacteriological analysis.

Even such skilled observers as Gaffky at Wittenburg, Koch and Cramer at Zurich, Simmonds at Hamburg, and Reitsch at Pas des Lanciers were unable to detect the bacilli, although the water was certainly the cause of the epidemics observed in the above named places. On the other hand, we have as positive evidence the finding of the bacilli in a well at Mulheim, the water of which was known to have caused typhoid in fourteen persons. Beumer found it at Greitswald under similar circumstances, and so did Rodet at Sous-Ville-Charmoux, and Arloing at Cluny. Widal found it at Paris, and Chantemesse at Çlermont-Ferrand and Pierrefonds. The latter was a particularly interesting case, as large numbers of the bacilli were found in the well—twenty-five thousand to the litre the water of which caused typhoid fever in every one of the party of twenty persons who came from Paris, and who drank the water. There was no typhoid elsewhere in the place at that time. The chemical analysis of the well did not indicate any great pollution; indeed was better than the neighboring wells in which the bacilli were not found, and which did not cause the disease. In Italy the bacillus had been found in drinking water which was the cause of the disease, by two observers. Kowalski found it at Vienna in 1886 and da Rocha at Coimbre. In this country Vaughan found it in water which caused an epidemic at Iron Mountain, and in the air which produced the disease at the Michigan State Prison. At Cincinnati, in 1887, there was a moderate epidemic of typhoid fever, and Rochford found the typhoid bacilli in the city water. In all, there are thirteen recorded instances in which the bacillus of Eberth has been found in waters known to have caused typhoid, and once in air. Since this organism is so constantly found in cases of typhoid, and in the essential lesions of the disease, and in the evacuations of the patient, which are known to be contagious, and since it has been found repeatedly in water and air which were known to cause the disease, we are forced to the conclusion that it is the essential factor of its production. And this is rendered still more certain by the negative evidence of its absence, as shown by repeated biological examina-

*Boston Medical and Surgical Journal, June 20th, 1889.

tions of drinking water, as at Pierrefonds mentioned above, and by the fruitless search that has been made for it in other diseases.

In a paper published in 1885 I said that there was no good evidence that the so-called typhoid bacillus of Eberth was really the cause of the disease; but since that time the evidence has accumulated so that one is justified in considering the germ theory a theory no longer, so far as typhoid fever is concerned.

* * * *

During the latter part of November, 1888, typhoid fever began to increase quite rapidly, and quite abruptly, about the 23d of the month. The increase culminated on December 1st when twenty-eight cases were reported, and the epidemic ceased almost as suddenly as it began, on December 12th. The following are the cases reported during the weeks ending November 17, 6; November 24, 11; December 1, 24; December 8, 139; December 15, 84; December 22, 16.

There were 15 deaths in November, 47 in December, and 5 in January. It will thus be seen that the epidemic was short, severe, and abrupt. The increase of typhoid was at this time confined to this city. It did not affect the neighboring towns. It was pretty evenly distributed throughout the city. As soon as these facts were determined, which was not until December 1st, suspicion was at once thrown on the public water supply as being the one cause most likely to affect the whole city, and not affect our near neighbors. Inquiry was made of the physicians in the valley of the Pawtuxet, to see if typhoid had been prevailing there. It was found that it had been prevailing from August to December 1st at Natick. It had attacked some twenty persons living in tenements near the river. The place was visited, and it was found that the inhabitants of the houses had been accustomed to throw slops and excrement on the banks of the stream, where they would be sure to wash in with a heavy rain, and where they might get in at other times. On November 9th and 10th there was a heavy rain. Natick is situated three and quarter miles above the pumping station, where the water is pumped directly into the Sockanosset reservoir, which holds ten to twelve days supply. I am informed by the city engineer that two or three days might elapse (owing to the volume contained in the mains) before the water taken in at the pumps would actually reach the consumer. As ten to eighteen days is the probable incubation of typhoid the ascertained facts are all in accord with the view that the epidemic was caused by the infection of the public water supply. But another test was applied. Dr. Swarts had shown that domestic filters are collectors and incubators of the microbes found in the water which passes through them. This fact was made use of, and several filters taken from houses where there had been typhoid and examined for the bacilli. The water itself was only partly examined December 1st. Attention was given to the filters because it was thought that they surely would contain the organism of the disease, if it had been in the water, even if it had then disappeared. Two filters were examined by Dr. Prudden of New York, and the typhoid bacilli was found in one. Two were

examined by Dr. Ernst, of Boston, and the bacilli was found in both. Two were examined by Dr. Swarts, and the typhoid bacilli found in neither. All observers found other organisms characteristic of human fæces.

EXPERIMENTAL WORK WITH THE BACILLUS OF TYPHOID FEVER.

The steps which were formulated by Koch as necessary to be successfully carried out in order to prove the pathogenic character of a micro-organism were:

1. The micro-organism in question must be found in the blood or tissues of the diseased man or animal.
2. Pure cultures must be made of the micro-organism.
3. The pure cultures when inoculated upon experimental animals must re-produce the disease.
4. The micro organism in question must be recovered from the blood or tissues of the animals in which the disease has been artificially produced.

It is now generally conceded that requirements 3 and 4 may be impracticable when applied to some pathogenic germs. The infection of some diseases has a wide range of victims in the animal kingdom, as tuberculosis and anthrax, while others may be restricted to a single species of animals. As regards typhoid fever, it is not definitely known that it ever affects any other animal organism than man's, and in the inoculation experiments of the typhoid bacillus upon the inferior animals, the results have mostly been negative or doubtful, and the question of the pathogenic character of the bacillus of Eberth may have to be decided largely upon other grounds,—for instance, upon the constant or nearly constant presence of the bacillus in the bodies of typhoid fever patients, and upon the co-incidental prevalence of typhoid fever with the finding of the bacillus in suspected water supplies or other ingesta.

The first to test pure cultures of the typhoid bacillus upon animals was Gaffky* as he was the first to make pure cultivations of this micro-organism. By injection into the circulation of the blood, by injection into the peritoneal cavity, or by feeding, he sought to inoculate a great variety of animals—apes, rabbits, guinea pigs, white rats, white and gray house mice, field mice, doves, hens, and calves—but always with negative results.

To quite opposite results Fränkel and Simmonds arrived in their work in the General Hospital in Hamburg. Their first experiments

*Mittheilungen a. d. Kaiserl. Gesundheitsamte, Band II.

in which the pure cultures were brought directly into the small intestine, or atomized and given to the test-animals by inhalation were without result, but when the bacillus in pure culture was injected directly into the veins, some of the animals died after severe symptoms, among which was diarrhœa, and at the post-mortem examination the pathological changes were similar to those found after typhoid fever.*

Seitz also experimented upon animals by injecting through a fine catheter into the stomach the bacillus in pure culture, after neutralizing the natural acidity of the gastric secretion, and slowing the peristaltic action with opium. He produced in this way results similar to those by the experimenters just mentioned. He believes that in cases of typhoid fever the systemic action of the bacillus is exerted from the intestinal tract where it multiplies and secretes its poison.

A. Fränkel experimented upon fourteen guinea pigs by injecting the culture liquid into the duodenum with positive results in seven of the animals and thinks that a genuine infection was caused. At the post mortem examinations the following changes were noted: distinct swelling of the spleen from which the bacillus was recovered, swelling of Peyer's patches, and in one animal, in the lower part of the ilium, upon the site of one of Peyer's patches, a fresh circular ulceration with distinct vascular injection of the surrounding tissues, the edges of the ulcer floating when a stream of water was directed upon it. The ulceration was more than one-half centimeter in diameter. Generally the contents of the intestine were liquid and the mesenteric glands were swollen. The bacillus of Eberth was found in microscopic sections of the hardened tissue of Peyer's patches and the intestinal wall.

One of the explanations which has been given respecting the way in which pathogenic bacteria carry on their warfare against the body which they have invaded, is, that in the exercise of their vital activity, chemical poisons are produced which are injurious to, and sometimes destructive of, the animal organism which has to contend against these parasites. We referred in our second annual report to the fact that Brieger, of Berlin, had isolated a ptomaine (typhotoxine) from pure cultures of the typhoid bacillus of Eberth, and that this alkaloid produces toxic effects when injected into animals.

Referring to the above-mentioned experiments of Fränkel and Simmonds and Seitz, Sirotinin† claims that the doses of the pure

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*Uffelmann's Sup. for 1886.

†Zietschrift fur Hygiene, I, 465.

cultures which they used were relatively to the sizes of the animals experimented upon (mice and rabbits) very large, and that the symptoms which were produced were the result of poisoning by means of the ptomaines of the pure cultures rather than a real infection by the multiplication of the bacilli within the system, and he adduces the results of two lines of experiments which were done in the laboratory at Gottingen at the suggestion of Prof. Flügge.

In the first series he gave the experimental animals the pure cultures, in the same doses, by intra-venous injection, by intra-peritoneal injection, by sub-cutaneous injection or by the mouth, as were employed by Fränkel and Simmons, but first destroyed or removed the bacilli by heat or by filtration. He concludes that thus he produces the same symptoms, the death of the animals within the same periods of time, and the same pathological alterations as when the cultures are used with the living bacilli. He found, also, that the intensity of the symptoms depended upon the dose. In his second series he sought to determine whether a veritable multiplication of the bacilli takes place in the bodies of the animals, and he concludes that no marked multiplication occurs and that the symptoms are principally due to intoxication (poisoning) rather than to infection.

Beumer and Peiper* of Greifswald, also investigated this subject by two series of experiments.

In the first series a suspension of the pure culture in distilled water was injected into the peritoneal cavity of eighty mice, in doses of from 1-20 drop to 20 drops.

The symptoms depended upon the size of the dose. In the first lot of ten, in which 1-20 drop was used, none died. In the seventh and eighth lots, in which 10 and 20 drops respectively were used, all (20) died.

In the second series, rabbits and guinea pigs were used. The results also varied with the size of the dose. The pathological changes found were an enteritis located in the *upper* part of the small intestine, and an enlargement of Peyer's patches, the mesenteric glands, the spleen, liver and kidneys.

Their experience leads them to conclude that the bacillus does not multiply in the species of animals which they used, but on the contrary rapidly disappears.

*Zeitschrift fur Hygiene.

In the following year (1887) Beumer and Peiper * communicated the results of a new series of experiments in the same line of enquiry. They administered the pure culture of the bacillus in varying doses to rabbits, guinea pigs and mice.

To mice subcutaneously, while 1-20 to one drop of the watery suspension killed none of the animals, five drops killed three, ten drops four, and twenty drops killed five out of five.

The rabbits and guinea pigs received the bacillus by injection into the stomach in accordance with the method used by Koch in infecting animals with the cholera bacillus, slowing of the peristaltic movement with opium and neutralizing the acids of the stomach with a solution of carbonate of soda.

In all these experiments they utterly failed to produce symptoms or pathological changes which bore any resemblance to those of typhoid fever as A. Fränkel claimed to have done, and they re-affirm the conclusion which they reached before that the bacillus is not pathogenic for those animals which have been experimented with,—that is, that the bacilli do not multiply within their bodies,—and that the effects are purely toxic, depending upon Brieger's typhotoxin or other ptomaines.

One fact of special interest, which they brought out accidentally and afterwards confirmed by a series of experiments, is that animals which have outlived the first inoculation of the bacillus, have acquired an immunity more or less complete against future inoculations.

Thus with two series of animals of ten each, in the first ten, two drops were injected, resulting in the death of three. Fourteen days afterward the seven remaining ones each received ten drops, a dose which had been found to be almost invariably fatal. Of the seven, only three died. Still better results were obtained when the transition from the minimum to the maximum dose was gradual. Thus the ten animals in the second series received at first one drop, in fourteen days, three drops, then six drops, and finally ten drops each. In this way only one animal was lost. These results the authors think, are suggestive of the possible future practicability of a protective "vaccination" against typhoid fever.

Fränkel and Simmons† in a further communication on the "Ætiologie des Abdominaltyphus" after repeating the experiments of Sirotinin with sterilized cultures, accorded to the latter the credit

* Zeitschrift fur Hygiene II, 110. † Zeitschrift fur Hygiene, II, 138 (1887).

for proceeding on the assumption that, while the bacilli are killed by heat, the poisonous ptomaines (typhotoxin) are not destroyed, and acknowledged that Sirotinin is right in his claim that the induced disease of the animals is due to the ptomaines of the cultures. Nevertheless, they are not ready to coincide with Sirotinin's cautious affirmation that "a marked multiplication of the bacilli does not take place in the animal body," though they do not wish at present to claim the opposite.

Referring to the negative evidence given by Beumer and Peiper's observations, and to some of their theoretical considerations, Fränkel and Simmons say that in a series of observations on rabbits which far outnumber those of Beumer and Peiper's they have regularly found disease of the lower part of the small intestine, particularly of Peyer's patches, that in three cases they have discovered circumscribed sloughing (Verschorfung) of the "follicular apparatus," that in many animals there was an enormous swelling of the mesenteric glands, that in fact there was often a coincidence of pathological changes, such as is found in well marked cases of typhoid fever in man.

In this country, Dr. V. C. Vaughan and F. G. Novey, M. S. of the Michigan State Laboratory of Hygiene, claim to have been the first to discover the bacillus of typhoid fever in this country, and to have instituted inoculation experiments with it. In 1887 an outbreak of typhoid fever occurred at Iron Mountain, Michigan. Bacteriological examination of the suspected water was made and the presence of the bacillus of Eberth was demonstrated by the potato culture. A hypodermic syringeful of a liquid culture of the bacillus in meat-petone bouillon was injected into the abdominal cavity of a cat. There was at first a fall in the temperature of the animal, with a subsequent rise to three degrees above the normal on the second day. The animal was killed on the third day. "The mucous membrane of the small intestines was slightly hyperæmic, and in the region of Peyer's glands were observed four little ulcerations about the size of a pin head. Two or three similar ones were found in the ascending colon, but one of these was about four times as large as those in the small intestines, and around it was quite an area marked by inflammatory action."

At the meeting of the Michigan State Board of Health, Dr. Vaughan made the following verbal report of further experiments.*

* Sixteenth Annual Report of the State Board of Health of Mich.

During the quarter, dogs and cats had been inoculated with the typhoid germ found in the Iron Mountain drinking water, and a regular run of typhoid fever was produced in the dogs, the same as in man whereas the cats when inoculated, died very soon. The inoculation was by a hypodermic syringe into the abdominal cavity. March 5, the three dogs were inoculated with the Iron Mountain germ. After the inoculations, the temperature of the dogs were taken for three or four days and found to be normal. No further attention was given to them until the first dog died. In two weeks the dogs were taken sick. One died April 1, twenty-six days after the inoculation, one died April 8, and one will probably get well.

On post-mortem examination, the mesenteric glands were found to be much enlarged, the regular typhoid lesions were recognized, and in one dog there were five or six ulcers in the intestines.

One dog was inoculated with sterilized culture, and this dog died first, but all the dogs were kept in the same pen, and the bacilli of typhoid fever were found in his intestines.

March 5, a vicious cat was inoculated with twice the quantity used on a dog; the cat died that night. The germs were found in the intestines; the mucous membrane was destroyed.

PREVENTION OF TYPHOID FEVER.

The preventive circular of the State Board of Health on Typhoid Fever says: "The poisonous germ is not thrown off through the breath, or in the exhalations from the skin, as is the case in some other infectious diseases; but in this disease it is contained in the discharges from the bowels, and possibly also in that from the kidneys."

The possibility of infectiousness of the excretion from the kidneys is changed into a certainty by the discovery by Carl Seitz of the bacillus of typhoid fever in the urine. Hence, again quoting the words of the circular, "the proper disposal of the excreta is a matter of the first and highest importance," and the prevention of typhoid fever resolves itself largely into measures for utterly destroying the infectiousness of the excreta as the first step in the proper disposal of it.

As a destroyer of the infectiousness of excreta whether in the sick room or in vaults, chloride of lime freely used is undoubtedly the most efficient of chemical disinfectants. For this purpose Solution A may be used consisting of chloride of lime, six ounces, water, one gallon. Mix. This solution decolorizes and destroyes fabrics, and therefore, should not be used as a disinfectant for clothing. For the disinfection of excreta, corrosive sublimate, one of the best dis-

infectants for certain purposes, is not so trustworthy; it coagulates albuminous matters and the coating thereby formed has a tendency to prevent the penetration of the disinfecting action of the agent into the interior of lumps or masses of excreta.

Next in value to the chloride of lime as a disinfectant of excreta, undoubtedly stands carbolic acid, especially when re-inforced with an acid, as is recommended by Laplace. For this purpose, about six drachms of tartaric acid may be added to each gallon of solution E. Solution E consists of carbolic acid, (90 per cent) 7 ounces; water, one gallon; mix.

Whichever disinfectants are used should be used in excess. A pint or more of the solution should be placed in the vessel to receive the discharges, which should remain subjected to the action of the disinfecting solution for at least one hour before being thrown out.

Dr. Vilchur, of St. Petersburg, has found that boiling water destroys the typhoid bacilli in stools when used in quantity equal to four times the volume of the matter to be disinfected.

The further disposal of the typhoid discharges should be such that there can be no possibility of their finding their way into sources of water supply either by soakage through the soil or by surface wash, as after heavy rains.

Additional rules for avoiding typhoid fever infection will be suggested to the intelligent reader by looking over the histories which are given under the heading, "Impure Water and Typhoid Fever."

Light Gymnastics for Schools.

By F. N. WHITTIER, A. M., M. D., Director of Sargent Gymnasium at Bowdoin College, Brunswick, Me.

The past decade has marked a new era in the history of physical training. During that time it has been taken from the hands of prize fighters or worn out circus athletes, and placed under the charge of medical men or men trained and educated expressly for this work.

The strengthening of the weaker parts, has come to be the great object of physical training as it should be of mental training. "That the weakes' place mus' stan' the strain," is truer of our bodies than of anything else, and in this case, also, the only remedy "is jest to make that place uz strong uz the rest." A point that many do not understand is this, that by means of the proper gymnastic exercises it is often just as easy to strengthen weak hearts or lungs as it is to strengthen a weak back or a weak biceps. In such cases not only is the general health improved but also the chances of long life are greatly increased.

Most of the courses of physicial training offered in our colleges and large schools, are patterned after the plan devised by Dr. D. A. Sargent of Harvard University, a native of Maine and a graduate of Bowdoin who has probably done more than any one else for the advancement of physical education.

Dr. Sargent's plan in brief, is this: each student, on his first entrance to the gymnasium, is subjected to a strict physical examination. Such points in his personal and family history, as may have had a bearing on his growth or development, are noted. Fifty different measurements are taken. The strength of various sets of

muscles tested. The heart and lungs are carefully examined. Having by this means found in what parts the student is weak, the examiner prescribes specific exercises for such parts, prescribing one exercise for a weak back, another for weak lungs, keeping carefully in view the nature of the weakness in each case.

In addition, class exercise is generally required. Here may be given, the "free hand" exercises which are calisthenic exercises performed without apparatus, or the exercise may be with dumb bells, Indian clubs, wands or chest weights, while only the stronger students are allowed to exercise on the heavy apparatus, such as parallel bars, rings etc. In most of the class exercises the students are required to keep time to music or to the counting of the instructor.

The advantages of these class exercises are three-fold.

(1) The exercises are so arranged as to give, as nearly as possible, the amount of exercise needed by each muscle of the body.

(2) The performance of difficult movements, or perhaps several movements at the same time, tends to increase the command of the mind over the muscle, and gives grace where before there was awkwardness.

(3) The demands upon the powers of attention, of will and of self-control in the course of the accurate performance of gymnastic drills, give a valuable mental discipline.

Now what have been the results of this system?

As to physical results, records have generally been carefully kept and in many cases published. They uniformly show such striking gains that they are almost incredible, except to one who has had some experience of this kind. Indeed physical training, supplemented by out of door athletics, has completely changed the type of college men. A generation ago the very name, college student, presented to the mind a picture of a youth, slight, pale and stooping, with a tendency toward phthisis. Now it is probable that no class possess finer physiques or enjoy better health than do college men. In regard to the effect upon scholarship, it has been the uniform testimony of all educators who have given the plan a fair trial, that a proper amount of time given to physical training enables the student to do at the same time better mental work.

But the field of the college gymnasium is narrowed, first, because of the comparatively small number whom it can reach, and again because many college students have passed the age at which gym-

nastic exercises give their best effects. After growth has ceased and the bones, ligaments and muscles have become stiffened in their positions, it is difficult, and in some cases impossible, to remove weaknesses or deformities that could easily have been corrected or prevented a few years before.

How then can physical training be brought within reach of all? There seems to be only one way to accomplish this, and that is to place it in the public schools. It is plain that the college system must be greatly simplified and that our first attempts must be on a very small scale. But at the same time we must insist that we have physical training and not simply a set of gymnastic exercises. The "gymnastics," as taught in most schools, consists of a series of exercises collected from various sources, arranged in an order without rhyme or reason, without any thought in regard to what each exercise is doing or what ought to be done. No harm can come from these light calisthenic exercises; in most cases they do much good. And yet the good results fall far short of what might be obtained from more systematic and scientific work.

The modern system of physical education must fulfil several indications. (1) Each muscle of the body should receive as nearly as possible the amount of exercise necessary to keep it in healthy condition and to insure its proper growth and development, while at the same time the work should be vigorous enough to properly exercise and develop the vital organs. (2) When we find certain muscles or organs to be weak in comparison with others we must strengthen the weak parts by special exercises arranged for the purpose. (3) The exercises should be sufficiently complex and difficult that they may serve to train the mind as well as the body. As has been said, the effort necessary to the mastery of such exercises not only gives the mind more perfect command over the muscles but at the same time has no equal for developing and strengthening the powers of attention and of will.

The value of gymnastic exercises in the development of brain and the formation of character is just beginning to be understood. It has recently been well shown by the careful experiments carried on by Dr. H. D. Wey at the New York State Reformatory at Elmira. Wishing to give the theory a fair test, Dr. Wey selected twelve of the dullest boys in school and gave them a thorough course in physical training, the boys themselves having no knowledge of the object of the experiment.

Their average rank in their studies for the five months immediately preceding the experiment was about 45 per cent, while during the five months' course in physical training their average was 74 per cent, and what is still better, they maintained their advanced standing during the six months following the discontinuance of the course; thus showing that the effect was permanent. In his report Dr. Wey says, "With physical culture and improvement there came a mental awakening, a cerebral activity never before manifested in their prison life. Their faces parted with the dull and stolid look they had in the beginning, assuming a more intelligent expression while the eye gained a brightness and clearness that before was conspicuous by its absence."

That the physical training had also an effect upon their moral natures is made evident by the fact that Dr. Wey's records show that the gain in general deportment even surpassed the gain in scholarship.

So the connection between the fair mind and the fair body, which has been mentioned by every eminent writer on education, from Plato to Herbert Spencer, has been proved at last by scientific experiment.

The recognition of this principle enabled the Greeks to build up in a few centuries a civilization the finest in many respects that the world has ever seen. The failure to recognize it is filling our country with weakness and ill health, and, if the theory of most scientific observers is correct, with insanity and crime as well.

The ultimate system of physical education must be of gradual growth. The mistakes of one will be a source of profit to those who come after. Even if we had the perfect system now at command, it would be so far in advance of the ideas of the people that it could not be introduced. The thing to do now is to make a beginning, and then work out the complete system by the combined methods of theory and practice. In making this beginning, the first obstacle is the attitude of the teachers, who, though themselves often frightful examples of the need, generally object to the undertaking of anything of this kind. Others content themselves with giving calisthenic exercises that are so simple, easy and useless as to make the very term calisthenics everywhere a subject for jest.

I have heard teachers give three reasons for their objection to the introduction of gymnastic exercises in their schools.

(1) *No money to buy apparatus.* Now this can be met by giving free-hand exercises, which are indeed to be preferred in all cases at the start.

(2) *No suitable room in which to exercise; would have to exercise in the school-room, standing in narrow aisles.* To this it may be said that if a little care and ingenuity be used in the arrangement of exercises and pupils, the narrowness of the aisles will interfere very little.

(3) *No time for it; the school curriculum is already crowded.* This last reason they seem to regard as conclusive, but, if the experience of all those who have tried it is worth anything, no time is lost by giving a fair amount of attention to physical training. Was the twelve hours a week given by Dr. Wey to his class at Elmira a waste of time? But would it not be excusable even to graduate our boys and girls with one "ology" the less if by this means we could give them bodies sounder, healthier and more symmetrical?

On looking at a group of school children, one is struck by the commonness of certain physical defects brought about largely by their school life.

First, we find the "droop neck" and "round shoulders," caused by faulty positions and lack of proper exercise. Depending on similar causes we find weakness of the muscles of the back or abdomen, leading in aggravated cases to spinal curvature or hernia. Lack of vigorous exercise causes weak lungs and heart, which may predispose the individual to phthisis or heart disease later on in life. All these physical defects are more common in girls than in boys, for the reason that girls indulge less in vigorous sports and games, and without doubt these defects are the cause of much of the proverbial ill health of American women.

Our first duty then, in arranging a course of exercise for school children, is to pay special attention to these weaknesses and deformities which at their early age can be easily corrected. Take for example the droop neck, i. e. the inclination forward of head and neck, so common among students. The cause is weakness of those muscles whose office is to hold the head erect. This weakness is due either to lack of exercise of these muscles or, what is practically the same thing, the habitual inclination of the head as over a book or slate. Now how many children are ever properly instructed in regard to the correct method of overcoming this deformity?

Of course the natural treatment is to strengthen the weak muscles by means of the proper gymnastic exercises.

Instead of that, parents and teachers continually urge the child to "straighten up." In trying to do this a constant strain is placed on the weak muscles which has the effect of making them even weaker than before. In order to understand this point, it is necessary to see clearly the distinction between the true exercise of a muscle, which consists of alternate contraction and relaxation, and the keeping a muscle in a state of prolonged contraction as is the case when we are forcibly holding the head erect or are holding a weight at arm's length. In the former case the muscle is strengthened, in the latter it is made weaker.

Round-shoulders are caused by the weakening of a set of muscles which when strengthened are nature's shoulder braces. The artificial shoulder braces simply take the place of these muscles which, then having no work to do, become still weaker from disuse, thus making a bad matter worse.

Undue weakness of the muscles of the back or abdomen is often seen in school children. To this source three-fourths of the cases of spinal curvature and hernia may be traced. Among girls weakness of these muscles is caused or aggravated by the wearing of corsets which take the place of the muscles in supporting the body. Now we must constantly keep in mind this fact, that if we neglect to use a muscle, it becomes smaller and weaker in consequence. So, if when the corsets are first worn the muscles are strong, they soon become weak from disuse. If the muscles are weak at first, the corsets give a false sense of support, but in the end increased weakness is sure to result. When the corsets are loose they still produce the same effect, though in a somewhat lessened degree. Here as before the only correct treatment is the strengthening of the weak parts by the proper exercises.

In addition to the correction of these physical defects, we should aim to give vigorous general exercises which are sufficiently difficult that the effort necessary to perform them makes them the more interesting to the pupils and which at the same time tend powerfully to develop and train the powers of will and self control, important qualities of character in regard to which our modern system of education seems to have no concern.

In the series of exercises given here, an attempt is made to fulfill these indications. These exercises have all been carefully tested in the Brunswick Grammar School, where by the invitation of the principal, Miss Annette Merriman, the writer has been able to work

out a plan of exercise which it is hoped will prove suitable for an introductory course in the public schools.

There were in the school over one hundred pupils. Every seat was occupied and it was found necessary while exercising to occupy every particle of available space in the floor and aisles in order that the pupils might have room to perform the exercises without interfering with one another. The pupils were arranged in lines, each row of seats running parallel to the aisles furnishing one line. As there were in this case twelve rows of seats there were twelve lines in all. In arranging for the exercises five of these lines were required to march to the places assigned them in the floor or rear aisle. The other lines simply rose and stood in the aisles opposite their seats.

The method of handling the school was, in brief, as follows:

At the word—Gymnastics! spoken loudly and sharply, the pupils sit erect in their seats with arms folded. At the word—One! those who are to march out turn outward in their seats, facing the aisles. At the word—Two! they stand erect in the aisles, facing in the direction in which they are to march. The next command is—Forward—March! At the word—March! they step forward and march to the places assigned them. At the command—All—Face! they face the instructor. The next commands are directed to those lines remaining in their seats. At—One! they face the aisles. At—Two! they rise and stand in the aisles. The next command is directed to the whole school, and is—Take distance! at which any pupil may step to the right or left, forward or backward, in order to get room for the performance of the exercises. Distance may be tested by raising hands forward and sideward. The school is now ready for work.

After the exercises, at the word—One! the lines standing by their seats sit down, facing the aisles. At—Two! they face around in their seats, coming into position. Next, at the command —All—Face! the lines that marched out face in the proper direction for marching back to their seats. At—Forward—March! they march back. At—One! and—Two! they sit down as before. The instructor will find that he can handle the school much easier if he will first teach them some of the principles of the military drill, especially marching and facing.

Commands are of two kinds—cautionary commands and those of execution. For example, in the command, "Forward—March!"

Forward! is the cautionary command, while March! is the command of execution.

The scholars should be made to understand that they are not to move till the command of execution is given.

The instructor should deliver the commands clearly and sharply, and great precision should be required in all movements.

The exercises should be carefully explained and performed by the instructor before they are given to the class.

Fig. 1—Fundamental Position.

We will suppose now that the school is properly arranged for exercise. First teach them to stand in the fundamental position, as shown in Fig. 1. Here the heels are locked, the toes are turned outward so the feet form an angle of sixty degrees. The head and body are held erect, with the shoulders well back. The arms hang at the sides in a natural position. It will be noticed that this position is assumed on the last count of every exercise, and in all the simpler exercises, as those given first, this position is assumed on all even counts or beats, as 2, 4, 6, etc. The command for assuming this position is: In position—Stand! All movement necessary being done at the word Stand! which is the command of execution.

Fig. 2—Resting Position.

Another position, the resting position, will be found useful. (Fig. 2). Here the arms are folded in front, while the left foot is placed some six inches forward. The weight of the body rests mostly on the right foot. The command for assuming this position is: At Rest—Stand! The pupils should be drilled to assume these positions promptly at the word of command, and when not actually exercising should be kept in one or the other of these positions. The instructor must remember that all gymnastic exercises must be performed with the greatest accuracy, because, as has been explained, the discipline given by this accuracy is one of the things most to be desired, and again, if the exercises be performed in a careless way, the scholars themselves soon lose interest. While the more dash and snap he can infuse, the more interested the pupils will become. This makes it necessary for the teacher to learn to perform the exercises easily and gracefully before attempting to teach them to the class.

The exercises given are divided into Part I and Part II. Part I contains simple exercises for training the scholars to move together, and at the same time leading up to the more difficult movements. Part II contains a series of exercises, which, after they have been carefully taught and their order memorized by the scholars are to be used as a gymnastic drill. The pupils will perform this drill from beginning to end without stopping, keeping time to music or to the counting of the instructor.

PART I.

EXERCISE I—RAISING ARMS FORWARD.

Fig. 3—Arm Raised Forward—Step-Position F rward.

In position—Stand!

(1) Raise right arm forward (Fig. 3).

Begin! 1–2–3–4–5–6–7—Stop!

NOTE.—This exercise is performed with two motions. As the teacher counts ONE, each pupil raises the right arm, keeping it perfectly straight, into the position shown in Fig. 3; at TWO, the arm is brought down again into the position shown in Fig. 1.

The pupils will continue this exercise until they get the command—Stop! which will usually be given on the eighth count. The command for beginning any exercise is—Begin! spoken loudly and sharply. At first it is always better for the teacher to mark time

by counting—ONE, TWO, THREE, etc. It is usually found more convenient to count no higher than eight, but then to begin at ONE again.

Counting should be sharp and spirited. The rate of counting should be from 60 to 80 counts per minute. The movements are really changes from one position to another performed very quickly, exactly upon the count or beat of music. The position assumed upon one count or beat of music should be maintained during the interval preceding the next count or beat. *Care must be taken not to be confused by the positions of the feet shown by the cuts.* In all these arm exercises the feet remain throughout in the position shown in Fig. 1.

(2) Raise left arm forward.
Begin! 1–2–3–4–5–6–7—Stop!

(3) Alternately raise right and left arms forward.
Begin! 1–2–3–4–5–6–7—Stop!

NOTE.—At ONE, raise right arm (Fig. 3); at TWO, bring arm down (Fig. 1); at THREE, raise left arm, etc.

(4) Raise both arms forward simultaneously (palms down).
Begin! 1–2–3–4–5–6–7—Stop!

NOTE.—The teachers will often find it convenient to continue each exercise for a longer time than eight counts. In this case count up as high as 16 or 24 giving the command—Stop! on the 16th or 24th count. The pupils must understand that they are to keep on exercising until the command—Stop! is given.

EXERCISE II—RAISING ARMS SIDEWARD.

(1) Raise right arm sideward (Fig. 4). Begin! 1–2, etc.

Fig. 4—Arm Raised Sideward—Step-Position Sideward.

NOTE.—At ONE, the arm is raised into the position shown in Fig. 4; at TWO, return to position shown in Fig. 1, etc.

(2) Raise left arm sideward. Begin! 1–2, etc.

(3) Alternately raise right and left arms sideward. Begin! 1–2, etc.

NOTE.—At ONE, raise right arm (Fig. 4); at TWO, bring arm down (Fig. 1); at THREE, raise left arm, etc.

(4) Raise both arms sideward (Fig. 5). Begin! 1–2, etc.

Fig. 5—Arms Raised Sideward—Bending Knees.

EXERCISE III—RAISING ARMS FORWARD OVERHEAD.

Fig 6—Arms Raised Forward Overhead—Step-Position Forward.

Fig. 7—Arms Raised Forward Overhead—Rising on Toes.

(1) Raise right arm forward overhead (Fig. 6). Begin! 1–2, etc.

NOTE—at ONE, raise right arm overhead with palm forward and at the same time turn the face upward as shown in Fig 6.

At TWO, back to position (Fig. 1).

In every case, the arm while being raised or lowered, should be kept perfectly straight.

(2) Raise left arm forward overhead. Begin! 1–2, etc.

(3) Alternately raise right and left arms forward overhead. Begin! 1–2, etc.

(4) Raise both hands forward overhead, at the same time turning the face upward (Fig. 7). Begin! 1–2, etc.

NOTE.—It will be noticed that in all these exercises the scholars come back to the Fundamental Position (Fig. 1) on every even count as 2-4-6, etc.

EXERCISE IV—RAISING ARMS SIDEWARD OVERHEAD.

Fig. 8—Arm Raised Sideward Overhead. Step-Position Sideward.

(1) Raise right arm sideward overhead (Fig. 8). Begin! 1–2, etc.

NOTE.—Here the head is turned to the right, the face turned upward and the palm outward, as shown in Fig. 8.

(2) Raise left arm sideward overhead. Begin! 1–2, etc.

(3) Alternately raise right and left arms sideward overhead. Begin! 1–2, etc.

(4) Raise both arms sideward overhead. Begin! 1–2, etc.

NOTE.—Here the palms of the hands are turned outward; the backs of the hands toward each other.

The teacher should now have the pupils go through with all the exercises that have been given without stopping, repeating each movement four times, or during eight counts.

EXERCISE V—STEP-POSITIONS FORWARD.

(1) Step-position forward right (Fig. 3).

Begin! 1–2, etc.

NOTE—At ONE, the right foot is carried forward as if a step was to be taken (Figs. 3 & 6), except that the entire weight is supported by the left leg, while the heel of the right foot does not

touch the floor. No weight is rested on the right foot, which is turned slightly outwards. At TWO, come back to position (Fig. 1). In all these step-positions the arms are held at the sides, as in Fig. 1.

(2) Step-position forward left (foot).

Begin! 1–2, etc.

NOTE.—Same as (1), except that the left foot is used.

(3) Step-position forward alternately right and left.

Begin! 1–2, etc.

NOTE.—At ONE, the right foot is carried forward (Fig. 3); at TWO, it is brought back to position (Fig. 1); at THREE, the left foot is carried forward, etc.

(4) Rising on toes (Fig. 7).

Begin! 1–2, etc.

NOTE.—At ONE, rise on toes (Fig. 7); at TWO, back to position (Fig. 1).

EXERCISE VI—STEP POSITIONS SIDEWARD.

(1) Step-position sideward right (Fig. 4).

Begin! 1–2, etc.

NOTE—At ONE, the right foot is carried outward and at the same time turned so that the toe points directly toward the right (Figs. 4 and 8); at TWO, the foot is brought back to position (Fig. 1).

(2) Step-position sideward left.

Begin! 1–2, etc.

(3) Step-position sideward alternately right and left.

Begin! 1-2, etc.

(4) Bend both knees (Fig. 5).

Begin! 1–2, etc.

NOTE.—At ONE, bend at the knees as shown in Fig. 5; at TWO, return to the position shown in Fig. 1.

PART II.

SET I.

EXERCISE I—THRUSTING ARMS.

In position—Stand!

(1) Thrust arms sideward right, forward and upward in eight motions.

Begin! 1–2, etc.

Fig. 9—Arms to Thrust.

Fig. 10—Both Arms Thrust Sideward Right

NOTE.—At ONE, raise arms to thrust (Fig. 9); at TWO, thrust both arms sideward toward the right, keeping the feet unchanged but turning the shoulders so as to keep the arms parallel (Fig. 10); at THREE, bring arms to thrust (Fig. 9); at FOUR, thrust arms upward (Fig. 11); at FIVE, lower arms to thrust (Fig. 9); at SIX, thrust arms forward; at SEVEN, arms to thrust (Fig. 9); at EIGHT, arms down (Fig. 1).

Fig. 11—Arms Thrust Upward

(2) Thrust arms sideward left, upward and forward.

Begin! 1–2, etc.

NOTE.—The same as (1) except that at TWO, the arms are thrust toward the left.

(3) Thrust arms sideward right, sideward left and upward.

Begin! 1–2, etc.

NOTE.—At ONE, arms to thrust (Fig. 9); at TWO, thrust arms sideward right (Fig. 10); at THREE, arms to thrust; at FOUR, thrust arms sideward left; at FIVE, arms to thrust; at SIX, thrust arms upwards (Fig. 11); at SEVEN, arms to thrust; at EIGHT, arms down (Fig. 1).

(4) Thrust arms outward, upward and forward.

Begin! 1–2, etc.

NOTE.—At ONE, arms to thrust (Fig. 9); at TWO, thrust right arm sideward right and left arm sideward left simultaneously (Fig. 5); at THREE, arms to thrust; at FOUR, thrust arms upwards (Fig. 11); at FIVE, arms to thrust; at SIX, thrust arms forward; at SEVEN, arms to thrust; at EIGHT, arms down.

EXERCISE II.—RAISING ARMS FORWARD WITH STEP POSITIONS FORWARD.

In position—Stand!

(1) Raise right arm forward with step-position forward right (Fig. 3).

Begin! 1–2, etc.

NOTE.—At ONE, raise right arm forward at the same time taking the step position forward right (Fig. 3); At TWO, return to position (Fig. 1); repeat during the eight counts.

(2) Raise left arm forward with step-position forward left.

Begin! 1–2, etc.

(3) Raise arm forward with step-position forward, right and left alternating.

Begin! 1–2, etc.

NOTE.—At ONE, raise right arm forward at the same time taking the step-position forward right (Fig. 3); at TWO, return to position (Fig. 1); at THREE, raise left arm forward taking step position forward left, etc.

(4) Raise both arms forward and rise on toes.

Begin! 1–2, etc.

EXERCISE III—LUNGING FORWARD.

In position—Stand!

(1) Lunge forward right (Fig. 12).

Begin! 1–2, etc.

Fig. 12—Lunge Forward.

NOTE.—At ONE, arms to thrust (Fig. 9); at TWO, step forward with right foot, at the same time thrusting right arm upward, left arm downward, and turning the face upward, the eyes following the hand (Fig. 12); at THREE, arms to thrust (Fig. 9); at FOUR, arms down (Fig. 1); at FIVE, SIX, SEVEN and EIGHT, repeat.

(2) Lunge forward left (foot).

Begin! 1–2, etc.

NOTE.—In all foot exercises, whether lunges or step-positions, care must be taken not to allow the feet to drag when moving from one position to another.

SET II.

EXERCISE 1—THRUSTING ARMS DOWNWARD.

Fig. 13—Arm Thrust Downward.

In position—Stand!

(1) Thrust right arm downward (Fig. 13). Begin! 1–2, etc.

NOTE.—At ONE, arms to thrust (Fig. 9); at TWO, thrust right arm downward nearly to the floor, bending the body but keeping the legs straight (Fig. 13); at THREE, arms to thrust (Fig. 9); at FOUR, arms down (Fig. 1); at FIVE, SIX, SEVEN and EIGHT repeat.

(2) Thrust left arm downward. Begin! 1–2, etc.

NOTE.—Same as (1) except that the left arm is used.

(3) Thrust right and left arms downward alternately. Begin! 1–2, etc.

NOTE.—At TWO, thrust right arm downward; at SIX, thrust left arm downward.

(4) Thrust both arms downward. Begin! 1-2, etc.

NOTE.—At TWO and SIX, *both* arms are thrust downward.

This is an excellent exercise for strengthening the muscles of the back and abdomen.

EXERCISE II—RAISING ARMS SIDEWARD WITH STEP—POSITION SIDEWARD.

In position—Stand!

(1) Raise right arm sideward with step-position sideward right (Fig. 4). Begin! 1–2, etc.

(2) Raise left arm sideward with step-position sideward left. Begin! 1–2, etc.

(3) Raise arm sideward with step-position sideward, right and left alternating. Begin! 1–2, etc.

(4) Raise both arms sideward and bend knees (Fig. 5). Begin! 1–2, etc.

EXERCISE III—LUNGING BACKWARD.

In position—Stand!

(1) Lunge backward right.
Begin! 1–2, etc.

NOTE.—At ONE, arms to thrust (Fig. 9); at TWO, carry the right foot backward eighteen inches or more, at the same time thrusting the right arm upward and the left arm downward, as in Fig. 12. The position differs from Fig. 12 in having the right leg straight and left leg bent, instead of the right bent and left straight as in Fig. 12; at THREE, arms to thrust; at FOUR, arms down (Fig. 1), at FIVE, SIX, SEVEN and EIGHT, repeat.

(2) Lunge backward left.
Begin! 1–2, etc.

SET III.

EXERCISE I—SWINGING ARMS.


Fig. 14—Arms in Position Forward.

In position—Stand!

(1) Swing arms outward. Begin! 1–2, etc.

NOTE.—At ONE, raise both arms in position forward with palms turned inward (Fig. 14); at TWO, swing arms outward, keeping them perfectly level with the shoulders, into position sideward (Fig. 15); at THREE, swing them inward, coming back to position forward (Fig. 14); at FOUR, arms down (Fig. 1); at FIVE, SIX, SEVEN and EIGHT, repeat.

(2) Swing arms inward. Begin! 1–2, etc.

NOTE.—At ONE, raise arms sideward with palms downward (Fig. 5); at TWO, swing arms inward, into position forward, with palms downward; at THREE, back to position sideward (Fig. 5); at FOUR, arms down (Fig. 1); at FIVE, SIX, SEVEN and EIGHT, repeat.

(3) Swing arms outward and raise arms forward overhead. Begin! 1–2, etc.

Fig. 15—Arms in Position Sideward.

NOTE.—First three movements same as in (1); at FOUR, raise arms forward overhead with palms inward and face turned upward; at FIVE, back to position forward (Fig. 14); at SIX, swing arms outward (Fig. 15); at SEVEN, swing inward (Fig. 14); at EIGHT, arms down (Fig. 1).

(4) Swing arms inward and raise arms sideward overhead. Begin! 1–2, etc.

NOTE.—First three movements same as in (2); at FOUR, raise arms sideward overhead, palms outward; at FIVE, back to position sideward (Fig. 5); at SIX, swing arms inward to position forward with palms downward; at SEVEN, swing arms outward (Fig. 5); at EIGHT, arms down.

This exercise is particularly valuable for overcoming round shoulders inasmuch as it exercises and so strengthens the muscles that hold the shoulders back in position.

EXERCISE II—RAISING ARMS FORWARD OVERHEAD WITH STEP-POSITIONS FORWARD.

In position—Stand!

(1) Raise right arm forward overhead with step-position forward right (Fig. 6).

Begin! 1–2, etc.

(2) Raise left arm forward overhead with step-position forward left.

Begin! 1–2, etc.

(3) Raise arm forward overhead with step-position forward, right and left alternating.

Begin! 1–2, etc.

(4) Raise both arms forward overhead and rise on toes (Fig. 7).

Begin! 1–2, etc.

NOTE.—In all cases when an arm is raised or thrust overhead the face is turned upward following the hand.

EXERCISE III—LUNGING FORWARD AND THRUSTING ARMS DOWNWARD.

Fig. 16—Lunge Forward with Arms to Thrust.

Fig. 17—Lunge Forward with Arms Thrust Downward.

In position—Stand!

(1) Lunge forward right and thrust arms downward (Figs. 16 and 17).

Begin! 1–2, etc.

NOTE.—At ONE, step forward with the right foot, at the same time bring arms to thrust (Fig. 16); at TWO, thrust arms downward, bending the body (Fig. 17); at THREE, back to the position shown in Fig. 16; at FOUR, back to the fundamental position (Fig. 1); at FIVE, SIX, SEVEN and EIGHT, repeat.

(2) Lunge forward left and thrust arms downward.

Begin! 1–2, etc.

SET IV.

EXERCISE I—CROSSING ARMS.

Fig. 18—Arms Crossed Forward.

Fig. 19—Arms Crossed Overhead.

In position—Stand!

(1) Cross arms forward (Fig. 18). Begin! 1–2, etc.

NOTE.—At ONE, raise arms sideward (Fig. 5); at TWO, cross arms forward, right arm uppermost (Fig. 18); at THREE, back to position sideward (Fig. 5); at FOUR, arms down (Fig. 1); at FIVE, SIX, SEVEN and EIGHT, repeat; at SIX, crossing arms, with left arm uppermost.

(2) Cross arms overhead (Fig. 19). Begin! 1–2, etc.

NOTE.—At ONE, raise arms sideward in position, with palms forward (Fig. 15); at TWO, cross arms overhead, with head and neck drawn back and face turned upward (Fig. 19); at THREE, back to position sideward (Fig. 15); at FOUR, arms down (Fig. 1); at FIVE, SIX, SEVEN and EIGHT, repeat; at TWO, cross with right arm in front; at SIX, cross with left arm in front as in Fig. 19.

(3) Cross arms forward, overhead and forward. Begin! 1–2, etc.

NOTE.—First three movements as in (1); at FOUR, cross arms overhead (Fig. 19); at FIVE, arms in position sideward (Fig. 15); at SIX, cross arms forward (Fig. 18); at SEVEN, arms in position sideward (Fig. 5); at EIGHT, arms down (Fig. 1).

(4) Cross arms overhead, forward and overhead. Begin! 1–2, etc.

NOTE.—First three movements as in (2); at FOUR, cross arms forward (Fig. 18); at FIVE, arms in position sideward (Fig. 5); at SIX, cross arms over head (Fig. 19); at SEVEN, arms in position sideward (Fig. 15); at EIGHT, arms down.

NOTE.—This exercise is especially useful for correcting the "droop neck," or inclination forward of head and neck common among students. In pulling back the head and neck, as one is obliged to do in crossing the arms overhead, the muscles at the back of the neck, whose office is to hold the head and neck erect, are exercised and so strengthened.

EXERCISE II—RAISING ARMS SIDEWARD OVERHEAD WITH STEP-POSITIONS SIDEWARD.

In position—Stand!

(1) Raise right arm sideward overhead with step-position sideward right (Fig. 8).

Begin! 1–2, etc.

(2) Raise left arm sideward overhead with step-position sideward left.

Begin! 1–2, etc.

(3) Raise arm sideward overhead with step-position sideward, right and left alternating.

Begin! 1–2, etc.

(4) Raise both arms sideward overhead and bend knees.

Begin! 1–2, etc.

NOTE.—At ONE, raise both arms sideward overhead, with palms turned outward, at the same time bending knees; at TWO, back to position (Fig. 1), etc.

EXERCISE III—LUNGING BACKWARD AND THRUSTING ARMS DOWNWARD.

In position—Stand!

(1) Lunge backward right, and thrust arms downward.
Begin! 1–2, etc.

NOTE.—At ONE, carry the right foot backward, at the same time bringing arms to thrust. This position is like Fig. 16, except that here it is the left leg that is bent, while the right leg is straight; at TWO, bend body forward and thrust arms downward (Fig. 17); at THREE, back to the position assumed at ONE; at FOUR, back to the fundamental position; at FIVE, SIX, SEVEN and EIGHT, repeat.

(2) Lunge backward left, and thrust arms downward.
Begin! 1–2, etc.

It will be noticed that in Part II each movement occupies eight counts or beats of music, and that each set contains three exercises, the first being arm movements, the second, arm movements combined with step-positions, the third, lunges.

The exercises are arranged in this order, that they may be the easier to remember, that there may be constant change from one kind of exercise to another, and also that there may be a gradual leading up from the easier movements to those more difficult.

Care should be taken not to teach a new exercise until the pupils have fully mastered all that precede. Each day have the class review all they have learned. In reviewing, have the class go through with all the exercises without stopping, keeping time to music or to the counting of the teacher or a class leader.

Music should not be used until the class has mastered the exercises. It should never be used in teaching them. After exercises have been fully learned it is well to have the class perform them occasionally as a "silent drill" without the aid of counting or music. The teachers must insist that the exercises be performed with the greatest accuracy; it is only by this means that the interest can be kept up.

After Part II has been learned it should be performed daily as a drill. The length of the drill can be doubled, if necessary, by giving sixteen counts to each movement instead of eight. At the time of exercising the school-room should be thoroughly ventilated. In

cold weather it will be found convenient to have the exercises come just before recess so that the air of the room can be warmed again before the scholars return to their studies. The clothing worn must be loose with no tight belts or bands.

A word of caution to teachers. Don't require too much exercise at first. In giving class exercise the work must be no more severe than the weakest pupil can stand. Five minutes of brisk class exercise is enough at first, fifteen minutes is enough at any time.

Beside giving class exercises the teacher should note the physical defects of each pupil and recommend to each the exercises necessary to correct them. For example, for drooping necks or round shoulders, recommend Exercise I, Set IV, for round shoulders, Exercise I, Set III, should also be given. In case there is weakness of the muscles of the back or abdomen, give Exercise I, Set II, Exercise III, Set III, or Exercise III, Set IV. If one shoulder is lower than the other the following exercise may be given; at ONE, raise arms to thrust (Fig. 9); at TWO, thrust the arm on the side of the low shoulder forcibly upward while the other arm is thrust downward; at THREE, arms to thrust; at FOUR, arms down.

If the lungs are weak they will be greatly benefited by the class exercises, many of which were selected because of their value in broadening and deepening the chest, and which have been made sufficiently vigorous to tend to develop and strengthen the lungs and heart. The "breathing exercises," with which everybody is familiar, may be cautiously used, but in general it is better to develop the lungs in the natural way, i. e., by vigorous exercise, than by any such artificial method as "forced breathing." In certain cases where forced breathing has been carried to excess it has permanently dilated the minute air cells of the lungs and has thus brought about a condition far worse than that which it was designed to cure. Pupils may be arranged in little squads or classes, made up of those having the same defects, and required to do special work with a view to their correction.

The plan of exercise given should be adhered to during an entire school year. After the first year new and more difficult exercises may be given and for the older pupils apparatus should be provided. Dumb bells or wands add much to the interest of the exercise, but for the first year the free exercises are to be preferred, and indeed in all cases where the pupils are under twelve years of age.

As has been said, the plan of exercise given here is intended only as an introductory course. The advantages claimed for it are, *that it costs nothing*, *that the exercises can be performed in the school room between the aisles*, and *that the exercises given are just as valuable, though perhaps not so attractive, as exercises with apparatus.*

If an intelligent course of physical training could be given in our public schools, it would be but the work of a few years to banish drooping necks, round shoulders and narrow chests—in short, to completely change the physique of the American people.

The success or failure of any plan of physical training depends largely upon the instructor. The teacher must interest the pupils, must know what to do and how to do it.

The giving of gymnastic exercises with no idea of their uses or effects is like turning loose a sick child in a medicine closet.

The nervous, excitable child requires a different course of physical training from that required by one that is indolent and sluggish. The class work should be adapted to all, while in addition, each pupil should receive special training according to his individual needs.

The value of physical training as an aid to moral and mental culture must be constantly kept in mind. This may seem strange to those who regard education as simply the training of the logical faculty and the cramming of the memory; but the time is coming when all will realize that the true system of education is three-fold —moral, mental, physical; and that it is impossible to secure the highest development in any one of these lines without careful training in the others.

THE METRIC SYSTEM.

Length.

1 Myriameter	Mm	(10.000 m.)	=6.2137 miles.
1 Kilometer	Km	(1.000 m.)	=0.62137 miles.
1 Hectometer	Hm	(100 m.)	=328.0833 feet.
1 Decameter	Dm	(10 m.)	=393.7 inches.
1 Meter	M	(1 m)	=39.37 inches.
1 Decimeter	dm	(0.1 m.)	=3.937 inches.
1 Centimeter	cm	(0.01 m.)	=0.3937 inch.
1 Millimeter	mm	(0.001 m.)	=0.03937 inch.

Surface.

1 Hectare	Ha	(10,000 sq.m)	=2.471 acres.
1 Are	a	(100 sq. m.),	=119.6 square yards.
1 Centare	ca	(1 sq. m.)	=1550 square inches.

Capacity.

1 Kiloliter or Stère	Kl. or st.	(1,000 l.)	=61027.0515 Cu. inches,	=264.17 gallons.
1 Hectoliter	Hl	(100 l.)	=6102.7052 Cu inches	=26.417 gallons.
1 Decaliter	Dl	(10 l.)	=610.2705 Cu. inches	=2.6417 gallons.
1 Liter	l	(1 l.)	=61.0271 Cu inches	=1.0567 quarts.
1 Deciliter	dl	(0.1 l.)	=6.1027 Cu. inches	=0.845 gill.
1 Centiliter	cl	(0.01 l.)	=0.6103 Cu. inch	=0.338 fluid ounce.
1 Millileter	ml	(0.001 l.)	=0.0610 Cu inch	=0.27 fluid drachm.

Weight.

1 Millier or Tonneau	M. or T.	(1,000 Kg.)	=1 Kl. or 1 Cu. m	=2204.6 lbs. (avoird)
1 Quintal	Q	(100 Kg.)	=1 Hl. or 0.1 Cu. m	=220.46 pounds.
1 Myriagram	Mg	(10 Kg.)	=1 Dl. or 10 Cu. dm	=22.046 pounds.
1 Kilogram	Kg	(1,000 g)	=1 l. or 1 Cu. dm	=2.2046 pounds.
1 Hectogram	Hg	(100 g)	=1 dl. or 0.1 Cu. dm	=3.5274 ounces.
1 Decagram	Dg	(10 g.)	=1 cl. or 10 Cu. cm	=0.3527 ounce.
1 Gram	g	(1 g)	=1 ml. or 1 Cu. cm	=15.432 grains.
1 Decigram	dg	(0.1 g)	=0.1 ml. or 0.1 Cu. cm	=1.5432 grains.
1 Centigram	cg	(0.01 g.)	=0.01 ml. or 10 Cu. mm.,	=0.1543 grain.
1 Milligram	mg	(0.001 g.)	=0.001 ml. or 1 Cu. mm.,	=0.0154 grain.

One kilogram is equal to a weight represented by one liter of distilled water at 4 degrees C.

One inch = 2.5 centimeters nearly; one quart (wine measure) = 0.946 liter; one pound Troy = 0.373 kilogram; one acre = 0.4046 hectare.

To reduce (approximately) grains to grams, divide by 10 and from the quotient subtract one-third of itself; to reduce drachms to grams, multiply by 4; to reduce ounces to grams, multiply by 32.

To convert degrees of one thermometer scale into those of another. Fahr. into Cent.—Divide by 9, multiply by 5 and deduct 32; Cent. into Fahr.—Multiply by 9, divide by 5 and add 32.

GLOSSARY.

This Report has been prepared for the benefit of all classes of persons in the State, and as far as possible it has been the wish to make its language as clear and intelligible as possible. A few technical terms, however, are so inseparably interwoven into the consideration of the subject of public hygiene that the avoidance of their use is impossible, and as it is desirable that the general public should become acquainted with their meaning, and especially to know in what sense they are used in the present work, this Glossary is introduced.

Aerobic. Applied to bacteria that can flourish only in the presence of air.

Ætiology. [See Etiology.]

Anaerobic. Applied to bacteria which can grow in the absence of air.

Anorexia. Want of appetite.

Antiseptics. Agents which prevent or retard putrefaction; or as now understood, those which prevent the development of pathogenic or fermentative organisms. Some of these which, in weaker solutions, act as antiseptics, in stronger solutions, being destructive of the life of the organisms, are also disinfectants.

Autopsy. Ocular inspection; post-mortem examination.

Bacilli. The plural of bacillus.

Bacillus. One class of bacteria in which the length of the cells distinctly exceeds their thickness. They are sometimes arranged in threads.

Bacillus Anthracis. The bacillus of anthrax, the essential cause of the disease.

Bacteria. Unicellular Organisms, microscopic in size, on the border land between the vegetable and the animal kingdom, but now regarded as pertaining to the former.

Bacterium. The singular of bacteria.

Biology. The science of life.

Bovine Virus. Vaccine virus taken directly from the calf or heifer.

Clinical. Pertaining to a bed. Clinical observations are observations which are made at the bedside of the patient.

Contagion. The specific cause of certain diseases by means of which they may be transmitted. Also applied to the act of transmission of communicable diseases.

Contagious. Capable of being transmitted by contagion; communicable; infectious. But little effort has been made in this Report to discriminate between the meaning of Contagious and Infectious; although their derivation and original application were different, most of the later medical writers of Europe and America use the two words interchangeably. This, at least in works for popular use, is the less confusing way.

De novo. Anew. As applied to the origin of infectious diseases, their appearance independent of the contagion of preceding cases.

Deodorants. Substances which destroy offensive smells. Some, but not all deodorants, are also disinfectants. [See Disinfectants.]

Desquamation. The shedding of the outer skin, usually in scales, after scarlatina and some other diseases.

Diagnosis. The determination of the character of a disease.

Diagnosticate. To determine the character of a disease.

Diplococcus. Double bacteria, or those which are constricted in the centre in the process of division.

Disease Germs. Bacteria; micro-organisms whose reception into the system, and multiplication in it, produce the contagious diseases.

Disinfectants. Agents or substances by means of which the contagion of diseases may be destroyed. Often improperly applied to substances which, though useful as deodorants or antiseptics, are nearly or quite valueless as germicides.

Duodenum. The first and upper portion of the small intestine.

Dyspnœa. Difficult or labored breathing.

Endemic. Applied to diseases which prevail in particular localities or districts, and which are due to local conditions or causes.

Enteric fever. Typhoid fever.

Epidemic. Common to, or affecting many people at the same time; generally prevailing; the causes of epidemics were formerly very generally regarded as depending upon an "epidemic constitution of the atmosphere," but of this there has never been collected any satisfactory proof. The more we study epidemiology the more we are led to look to contagion and the laws which govern its diffusion for an explanation of the occurrence of epidemics.

Epizootic. Applied to the diseases of animals in the same sense as epidemic is used with reference to human diseases; affecting many animals at the same time.

Etiology. The causation of diseases.

Exogenous. Produced or generated outside the system.

Exotic. Foreign; a disease introduced from some other country.

Fission. Division; the common method of multiplication with many of the lowest organisms.

Fomites. Substances or articles which are liable to carry the contagion of diseases.

Germicides. Destroyers of germs; disinfectants.

Hepatization. A change through which the structure of the lungs or other organs comes to resemble liver.

House-drain. That part of the house-drainage system which carries the wastes from the soil-pipe and waste-pipe to the sewer.

Humanized Virus. Vaccine virus taken from the cow-pox vesicle which has been produced on the human arm, usually the arm of a child.

Hygiene. The science and art relating to the preservation of health.

Ileum. The third or lower portion of the small intestine.

Infection. Contagion: the specific cause of communicable diseases, now known in some diseases, and supposed in others, to be a microscopic organism.

Infectious. Communicable as a disease; contagious. [See Contagious].

Lesion. A hurt, wound, or injury of a part.

Meningeal. Pertaining to the meninges.

Meninges. The membranes that envelop the brain and spinal cord.

Meningitis. Inflammation of the meninges.

Miasm. A term vaguely applied to noxious exhalations.

Miasma. The same as miasm.

Microbe. Bacterium; micro-organism.

Micrococcus. A genus of the bacteria, consisting of very small, globular or oval organisms.

Œdema. A swelling from effusion of serous fluid into the cellular tissues.

Pathogenic. Generative or productive of disease.

Pathological. Pertaining to pathology; diseased.

Pathology. The knowledge of diseases.

Peritoneum. A serous membrane investing the abdominal walls and viscera.

Phthisis. Consumption; pulmonary tuberculosis.

Physiology. The science which treats of the functions of living animals or plants.

Prognosis. The prediction, from the present symptoms of a disease, of its future course or termination.

Quarantine. The enforced isolation of persons and things coming either by sea or land from places where contagious diseases exist.

Scarlatina. Another name for scarlet fever.

Serous. Relating to serum, or to the membranes which secrete it.

Serum. Watery, clear or yellowish, animal fluids, exhaled by serous membranes, or separated from the coagulable parts of other fluids, like blood or milk.

Sewage. The liquid and other filth conveyed in sewers.

Sewer. A drain for conveying dirty water and filth.

Sewerage. A system of sewers.

Soil-pipe. The pipe which conveys excreta from water-closets and urinals.

Sporadic. Applied to diseases, it means occurring in single or scattered cases, as opposed to epidemic or endemic, in which numbers or many are affected.

Spores. Minute grains or bodies which are formed within many of the lower flowerless plants, and which perform the functions of seeds. The microscopic one-celled plants which we call bacteria, multiply by fission, and in addition to this, some of them multiply by means of spores.

Sporification. The formation of spores.

Staphylococcus. Round bacteria, or cocci, arranged in groups like a cluster of grapes.

Sterilize. As used in bacteriology, the freeing of culture fluids or other substances, of bacteria which are capable of development.

Streptococcus. Cocci or round bacteria, arranged in rows or chains.

Tellural. Pertaining to, or proceeding from, the earth.

Tracheotomy. The operation of making an opening into the windpipe.

Trap. An arrangement on some part of the sewerage system, usually a bend in the pipe in which water stands, by means of which we seek to prevent the return of gases and disease germs into the building.

Tuberculosis. A specific disease usually characterized by the formation of tubercles. Pulmonary consumption is a tuberculosis of the lungs.

Typhoid Fever. Meaning literally a fever resembling typhus. The common fever of this country. Formerly typhus fever and typhoid were not distinguished, the one from the other. Typhoid fever is communicable only in a slight degree, if at all, by direct contagion; but there is great danger of its spread from the sick to the well from defective sanitary arrangements and regulations.

Typhus Fever. A dangerously contagious disease rarely found in this country, and when appearing in our State, probably always by importation. [See Typhoid Fever.]

Vaccination. Inoculation with the virus of cow-pox.

Vaccine Virus. The infective material from the cow-pox vesicle used in vaccination.

Variola. Small-pox.

Varioloid. Small-pox modified by vaccination. It is contagious, and as severe cases of small-pox may arise from exposure to its infection as from unmodified small-pox.

Waste-Pipe. That part of the house-drainage system which conveys the waste-water from sinks, baths, etc.

Zymotic. Characterized by fermentation. Applied to epidemic, endemic and contagious diseases, on account of the similarity between the process of fermentation and that which is started in the organism after its infection with the cause of any of these diseases.

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